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Original Communications.

EXPERIMENTAL WORK ON THREE TYPES OF STRETCHER SLINGS CARRIED OUT BY MAJOR A. E. RICHMOND, O.B.E., R.A.M.C.

By MAJOR D. T. RICHARDSON, M.C.,
Royal Army Medical Corps.

[THE experiments recorded were carried out by Major A. E. Richmond at the Royal Army Medical College in 1930, before his departure for India, and his notes have formed the basis of this paper written by Major D. T. Richardson.]

In the April number of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, 1932, Major-General D. J. Collins states that the Standardization Committee formed under the auspices of the Comité International de la Croix Rouge have standardized a new type of field stretcher and stretcher slings. We are not in a position to comment on the stretcher. It may be a marked improvement on the old pattern British stretcher in particular circumstances, but for hard wear and tear and general utility the latter is difficult to beat.

It does not surprise us, however, that the Committee has found a sling which is better than the obsolete British pattern, for this had no redeeming feature except that it was cheap and suitable for drill on the parade ground. Used as a means of carrying the stretcher, its effects on the unfortunate bearers were reminiscent of the sufferings endured by our forefathers on the gibbet. It was soon dispensed with on the outbreak of the war and hand and shoulder carriage by four bearers adopted instead.

It is a remarkable thing that we emerged from the war with no real

and practicable improvement in the method of carriage. What strikes one forcibly is the fact that whereas other beasts of burden have received consideration and have been fitted with saddle and pannier of the most comfortable type, the stretcher-bearer whose load is proportionately threefold as heavy has been, or appears to have been, neglected.

Consider for a moment what the total load carried by the stretcher-bearer amounts to. Taking the weight of the patient as 10½ stone the load consists of :—

Clothed casualty	.. ..	161 lb.
Arms and accoutrements..	.. .. ..	40 ,,
Stretcher	.. ..	27 ,,
Total	.. .. ..	228 lb.

The weight, therefore, if borne by two bearers, will amount to 114 pounds, which calculating on a bearer of ten stone is eighty per cent of his body weight, over 2½ times the optimum (thirty per cent), and 3½ times the percentage load carried by recognized beasts of burden, as is shown in the following table :—

	Body weight	Load	Percentage body weight
Donkey	450 lb.	100	22
Pony	700 ,,	170	24
Mule	700 ,,	170	24
Bullock	700 ,,	170	24
Camel (Arab) ..	1,120 ,,	300	22
Elephant	7,840 ,,	1,100	14

If borne by four bearers the load exceeds the optimum by ten per cent, even when the weight is distributed evenly over the carrying parts of the body.

The load of 57 pounds is transferred through the medium of a narrow wooden handle and concentrated on a small and bony area of the shoulder, to some extent relieved by hand support. Could anything be more uncomfortable? Yet long distances were covered by the hardened stretcher-bearers in France during the Great War. This does not mean, however, that experience proved it to be the most efficient method. One is apt to be blinded by what happened in France and to forget the many other fronts where ways and methods were different, or to concentrate one's attention on mechanical means of transporting the wounded and to neglect the human factor who, no one will deny, is the key to the successful evacuation of the wounded from the firing line.

We have the greatest faith in our men's sense of duty, but human nature is human nature, and it is not to be wondered at if the bearers, harassed by an exceptionally heavy load, seek a sequestered spot, and intentionally delay their return to the firing line. There would be much less chance of this happening if the carriage could be effected in greater comfort. This leads us to the subject of slings and to the type selected by the Standardization Committee in particular. One wonders how the chosen sling was decided on. Was a careful investigation both scientific and practical, carried out;

or was it merely selected because it was the best of a bunch, and there was no real attempt to devise something new ?

Experiments on three types of slings were carried out in the hygiene department at the Royal Army Medical College by Major A. E. Richmond, R.A.M.C. The investigation lasted three weeks and was carried out with meticulous care and exactness.

The three types of slings used in Major Richmond's experiments were :—

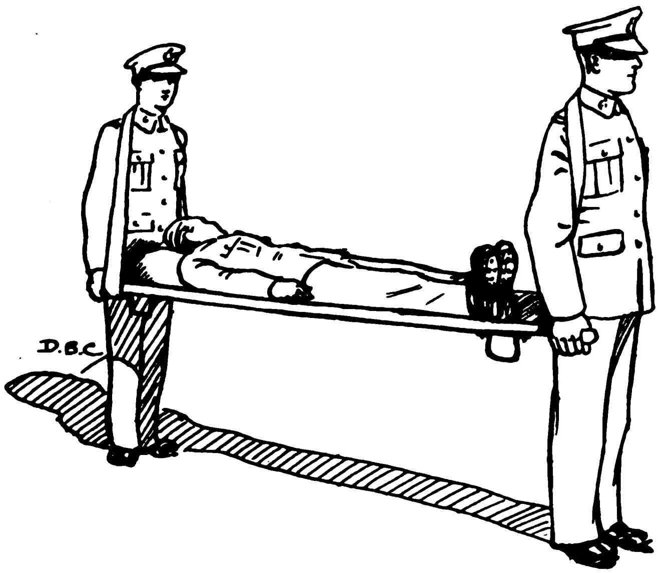


FIG. 1.—The British Pattern Sling.

(1) The British Army Pattern (obsolete). Fig. 1.

(2) The Polish Army Pattern. (The pattern selected by the Standardization Committee.) Fig. 2.

(3) An experimental pattern designed in the hygiene department, Royal Army Medical College. Figs. 3 and 4.

British Army Pattern Sling.

A detailed description is hardly necessary, yet to make the report complete it is better to include it.

The sling consists of a single narrow band of webbing, at each end of which is a loop through which the handles of the stretcher pass, one loop being adjustable so that the sling can be lengthened or shortened to suit the bearer.

When in position the centre of the sling lies across the base of the neck, the two ends stretching down to the handles in front.

Polish Pattern Sling.

This sling is a double sling of broad webbing, each portion having an adjustable loop at one end and a metal clip at the other.

When adjusted the slings are passed over the right and left shoulders with the looped ends in front. The rear ends cross one another between the shoulder-blades, one sling passing through a sleeve in the other. The ends are then brought forward, the left under the right axilla, and the right under the left axilla, and clipped to Ds which are fixed 9 inches or so above the loops in front.

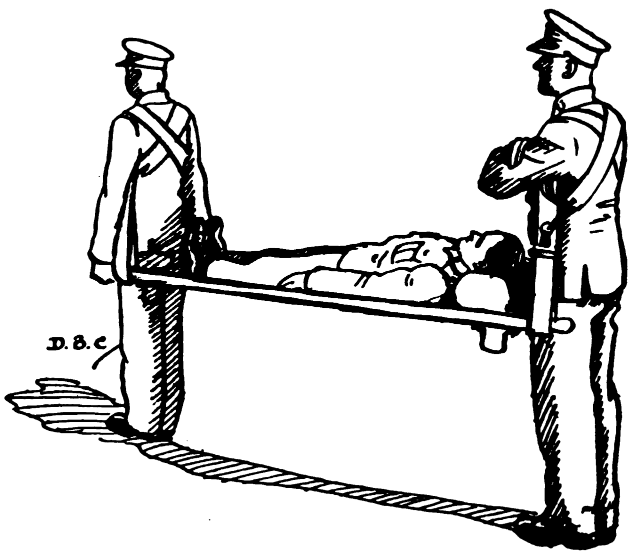


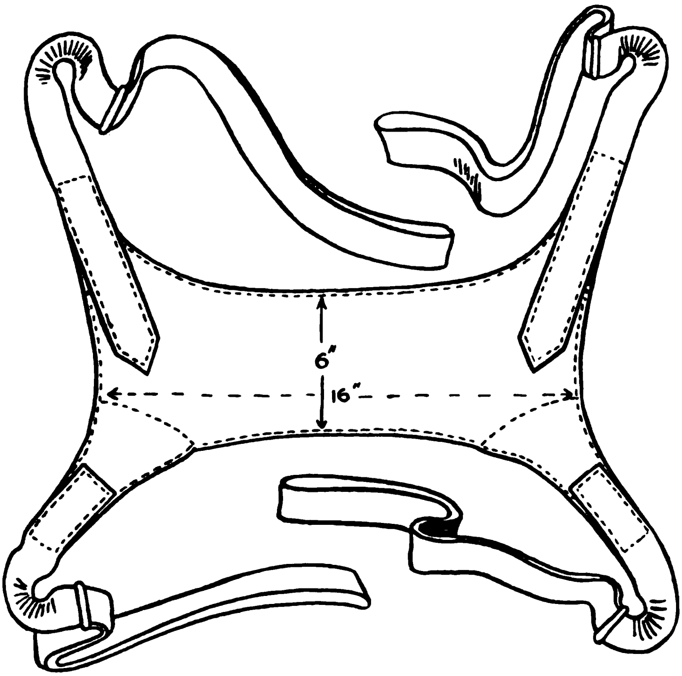
Fig. 2.—The Polish Pattern Sling.

Experimental Pattern Sling.

This sling is fashioned on the principle of the milkmaid's yoke. There is a rectangular piece 6 inches broad and 16 inches long, notched anteriorly to fit the posterior part of the neck. At each of the four corners a broad strap is attached, which has a looped end capable of being adjusted.

When in position the broad rectangular piece lies against the upper and back part of the chest without interfering with the movements of the neck, and covers the shoulders as far as the acromion process where the anterior and posterior straps originate.

An alternative suggestion is to construct the upper part in a shape somewhat similar to a waistcoat with large armholes and a single looped strap passing down each side. This modification would be less complicated, leave more room on the handles for the hands, and would require less adjustment.



Front.

Fig. 3.—The Experimental Pattern Sling.

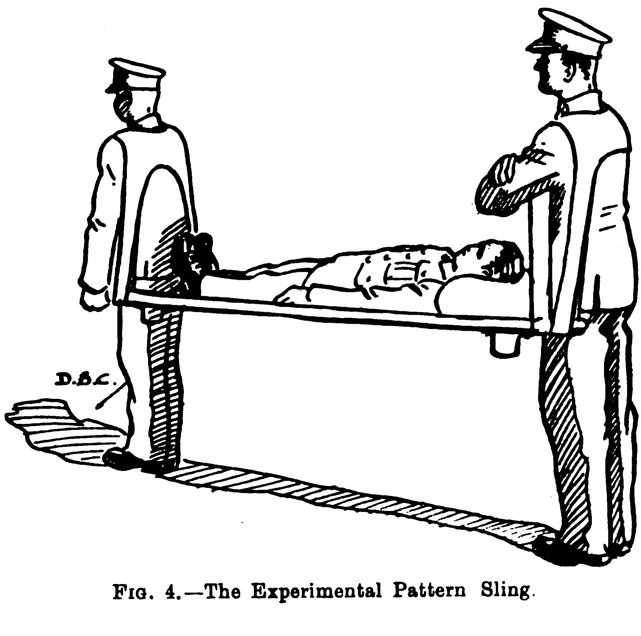


Fig. 4.—The Experimental Pattern Sling.

These were the types of slings used and the experiments included :—

(1) The estimation of the energy expenditure.

(2) Vital capacity tests to determine the degree of thoracic constriction.

(3) Effects of the work on the respiratory rate.

(4) Blood-pressure tests.

(5) A record of the subjective symptoms.

In all cases the blood-pressure experiments were a complete failure. Not only did the tightening of the grip in holding the stretcher obscure the pulse at the wrist, but the compression on the axillary arteries by the straps was such that the pressure was lowered rather than heightened. When the subject was relieved of the stretcher the blood-pressure returned to normal almost at once, therefore it was found impossible with the available apparatus to get any useful data on this subject.

Energy Expenditure Tests.

Two orderlies trained to wear the Douglas Haldane apparatus were selected as subjects, a third man acting as the patient throughout.

Basal metabolic rates were determined each day while the subjects were in the absorptive state, and at a time prior to the carrying out of the actual experiment.

It will be seen from Table I of the Appendix that the rates are normal for persons digesting a meal. Subject B has a metabolism at rest higher than A, and this increase is evident throughout all the experiments.

Twenty-four experiments were made, twelve on the bearer in position 1, and twelve on the bearer in position 2, for each type of sling.

The men marched at a rate kept constant by the beat of a metronome.

The average cost in calories per square metre per hour is shown in Tables II (A), II (B) and II (C) and also in Table III of the Appendix.

The British Pattern.—It will be seen that the average energy expended by the two bearers was 200 calories, and that the bearer in position 1 had the greater share of the work, the comparative costs of 1 and 2 being 204 and 195 calories.

The Polish Sling.—The average energy expended by bearers 1 and 2 was approximately the same as that in the previous experiment, but taken individually the heavier work fell on bearer 2 who expended 210 calories to 188 expended by 1.

The Experimental Sling.—The average cost for both bearers was definitely lower than in the preceding experiments. It amounted to 177·1 calories, and as in the second series position 2 was the harder, the bearer here expending 185 as compared with 169 calories by the bearer in position 1.

It is interesting to note that the difference in cost between the work performed by bearers 1 and 2 is corroborated by the subjective symptoms as expressed by the subjects.

With the British sling they preferred position 2, while carrying with the other two types they preferred position 1. The possible explanation may be that with the British sling there is a tendency for the *marche en flexion* to be adopted which throws the centre of the gravity forward and as a result 1 would tend to pull 2 along. With the other types the attitude in walking is erect, the pull being on the rear of the shoulders of 1 who is held back by the stretcher and has to be pushed on by 2.

In the first instance the progression is by traction, in the others it is by propulsion. On the other hand the position of the patient with his head to the rear may have something to do with it.

The net cost in gramme calories per square metre per horizontal kilogrammeter shows the same differences in the energy expenditure between the three types of slings.

British	Polish	Experimental	
37	35	30	Calories per square metre per horizontal kilogrammeter

(See Table IV, Appendix)

Vital Capacity Tests.—These tests were carried out on thirteen different subjects all practised in the art of blowing correctly into the spirometer.

Normal capacities were taken in the first instance and then after carrying a patient for 100 yards.

Table V of the Appendix shows how markedly the vital capacity is reduced by all patterns of slings, the Polish having the greatest while the Experimental showed the least effect. These findings are confirmed by the subjective symptoms experienced by the men, who state that, owing to its criss-cross nature, the Polish sling caused far greater constriction on the chest and hampered their breathing more.

Respiratory Rates.—During the vital capacity tests a number of respiratory rates were taken when the patient was being carried. The rate was increased sixty-six per cent above the resting rate, and again it was the Polish sling that caused the greatest interference with the breathing, while the Experimental sling showed least. The difference, however, is so slight that no great importance can be attached to it. (Table VI of the Appendix.)

Subjective Symptoms.—The subjective symptoms given in Table VII of the Appendix are those of the two subjects who carried daily for three weeks, and who had ample opportunities of criticizing and comparing the slings. They were unanimous that the Experimental sling was the most comfortable, that the Polish was less so, while the British type was blasphemously condemned.

The more important symptoms experienced with each sling were as follows :—

British Sling.—The pressure is severe and localized to the nape of the neck and the front of the axilla. This results in the following sequelæ :—

(1) The neck and chest are forced forward, and this bent attitude interferes with the expansion of the chest and respiration.

(2) The pressure causes acute pain in the muscles of the neck, which is kept fixed in a forward position.

(3) The pressure on the axillary vessels and nerves causes congestion and numbness, with tingling of the forearm and hand.

Other points worthy of note are, that the sling is easily adjusted on men of different statures, that lifting and lowering the stretcher is easy, and that the stretcher sways to and fro when carried.

Polish Sling.—The subjective symptoms when carrying with the Polish sling are somewhat different. The pressure is not so severe, being distributed more generally over the upper and mid-dorsal region and to some extent over the front part of the axilla.

The subjects complained of :—

(1) Definite constriction of the chest and interference with breathing.

(2) Considerable thoracic discomfort, which was especially marked in position 2.

The adjustment of this sling is complicated, and lifting and lowering the stretcher difficult. The looped ends do not drop to the ground when the bearer is in the bent position, but are drawn up the back. To overcome this, the stretcher must first be disengaged from the slings, and then raised or lowered.

The to-and-fro motion of the stretcher when carried is negligible.

The Experimental Sling.—The pressure is evenly distributed over the upper dorsal region and the back of the shoulders, and only very slightly over any region in front.

It was noted that:—

(1) There was comparatively little chest constriction, and none due to the attitude of the bearer, which was erect, and therefore breathing was only slightly hampered.

(2) The discomfort was least with this pattern, and was no more than could be expected in carrying such a weight.

The remarks regarding the adjustment of the sling and the raising and lowering of the stretcher given under the Polish sling, apply here, and their remedy is the same.

It may be added that the carrying was not continued for any great length of time, and therefore it is hard to say how soon fatigue symptoms would commence, or what the condition of the subject would be on the completion of a prolonged period of carrying with each type of sling. It is only common sense, however, to assume that a sling which is uncomfortable, causes pain and constricts the chest, will induce fatigue symptoms more rapidly, and use up a greater reserve of physical and mental energy, than one that sits comfortably on the correct carrying areas of the body.

Summary of Results.

All that can be gathered from the results of the experiments is that they appear to favour the Experimental Sling, but field tests are necessary to corroborate the findings.

TABLE I.—TABLE INDICATING IN CALORIES PER HOUR THE BASAL METABOLISM OF SUBJECTS A AND B IN ABSORPTIVE STATE.

Experiment—	Calories per hour Subject A	Calories per hour Subject B
1	40·60	45·19
2	42·43	46·34
3	38·10	41·00
4	44·96	47·71
5	40·56	45·54
6	43·43	41·57
7	45·07	52·24
8	40·80	46·74
9	40·13	47·26
10	42·83	49·38
11	—	47·50
12	—	50·35
13	—	43·18
	AVERAGE = 41·89	AVERAGE = 46·46

Note.—These estimations of basal metabolism were taken in each instance approximately two hours after breakfast, and after forty minutes complete rest.

TABLE II (A).

STRETCHER SLINGS. BRITISH ARMY PATTERN. CARRYING LOADED STRETCHER.

Cost in Calories per square metre per hour.

SUBJECT A.

Per minute		R. Q.	Per hour		Position in Squad
CO_2	O_2		Cals.	Cals. per sq. metre	
1·144	1·230	0·93	366·0	203·4	1
1·046	1·046	1·0	318·45	176·95	1
1·008	1·072	0·94	319·87	177·73	2
1·180	1·336	0·89	393·80	218·60	1
1·177	1·337	0·88	393·0	218·3	2
1·086	1·220	0·89	359·52	199·73	2
1·169	1·230	0·95	367·8	204·4	1
1·066	1·087	0·98	327·53	181·96	1
1·123	1·123	1·0	339·90	188·82	2
1·102	1 211	0·91	358·6	199·2	2
1·004	1·024	0·98	308·55	171·42	2
			AVERAGE =	194·6	

SUBJECT B.

Per minute		R. Q.	Per hour		Position in Squad
CO_2	O_2		Cals.	Cals. per sq. metre	
0·845	1·174	0·72	331·2	194·9	2
1·203	1·294	0·91	383·1	225·4	1
1·314	1·398	0·94	417·10	245·4	1
0·887	1·095	0·81	316·27	186·08	1
1·043	1·227	0·85	358·1	210·65	2
1·069	1·214	0·88	356 9	209·95	2
0·894	1·186	0·83	344·21	202·5	1
0·839	1·062	0·79	305·2	179·55	2
0·983	1·199	0·82	347·1	204 2	2
0·971	1·156	0·84	336·4	197·9	1
0·946	1·213	0·78	347·5	204·5	1
0·996	1·186	0·84	345·2	203·1	1
			AVERAGE =	205·3	

AVERAGE A + B = 200.20 calories per square metre per hour.

TABLE II (B).

STRETCHER SLINGS. POLISH ARMY PATTERN. CARRYING LOADED STRETCHER.

Cost in Calories per square metre per hour.

SUBJECT A.

Per minute		R. Q.	Per hour		Position in Squad
CO_2	O_2		Cals.	Cals. per sq. metre	
1·055	1·160	0·91	343·5	190·83	1
1·052	1·107	0·95	331·1	184·0	1
1·077	1·134	0·95	339·1	188·4	1
1·182	1·258	0·94	375·3	208·5	2
1·218	1·296	0·94	386·6	214·8	2
1·126	1·237	0·91	366·2	203·5	2
1·098	1·144	0 96	343·0	190·6	1
1·136	1·171	0·97	351·9	195·5	2
0·988	1·029	0·96	308·5	171·4	1
1·188	1·20	0·99	362·46	201·4	2
1·087	1·109	0·98	334·1	185·6	1
1·123	1·123	1·0	340·05	188·95	2
			AVERAGE =	193·6	

SUBJECT B.

Per minute		R. Q.	Per hour		Position in Squad
CO_2	O_2		Cals.	Cals. per sq. metre	
1·048	1·263	0·83	366·6	215·7	2
1·259	1·481	0·85	423·6	249·15	2
1·155	1·328	0·87	387·2	228·95	2
0·992	1·167	0·85	340·4	200·3	1
0·950	1·218	0·78	348·9	205·3	1
1·036	1·191	0·87	349·2	205·4	2
0·807	0·950	0·85	277·2	163·1	1
0·933	1·138	0·82	329·5	193·8	1
0·926	1·09	0·85	318·06	187·15	1
1·118	1·242	0·90	366·9	215·9	2
1·03	1·144	0·90	337·92	198·50	1
			AVERAGE =	205·7	

AVERAGE A + B = 199·4 calories per square metre per hour.

TABLE II (C).

STRETCHER SLINGS. EXPERIMENTAL PATTERN. CARRYING LOADED STRETCHER.

Cost in Calories per square metre per hour.

SUBJECT A.

Per minute		R. Q.	Per hour		Position in Squad
CO_2	O_2		Cals.	Cals. per sq. metre	
0·915	0·984	0·93	292·9	162·7	1
0·939	1·043	0·90	308·1	171·2	1
0·949	1·079	0·88	317·2	176·2	2
1·03	1·08	0·95	322·8	179·3	2
0·859	0·976	0·88	286·9	159·3	1
0·929	0·968	0·96	290·2	161·2	2
0·924	1·016	0·91	300·8	167·1	1
0·979	1·088	0·90	321·4	178·6	2
0·953	1·047	0·91	310·05	172·3	1
1·098	1·226	0·90	360·6	200·0	2
			AVERAGE =	172·8	

SUBJECT B.

Per minute		R. Q.	Per hour		Position in Squad
CO_2	O_2		Cals.	Cals. per sq. metre	
1·059	1·307	0·83	377·4	222·0	2
0·981	1·168	0·84	339·9	199·9	1
0·995	1·228	0·81	354·5	208·5	2
0·703	0·858	0·82	248·3	146·1	2
0·923	1·086	0·85	317·0	176·1	1
0·913	1·087	0·84	310·2	182·5	2
0·836	0·899	0·93	267·6	157·4	1
0·946	1·140	0·83	330·7	194·6	2
0·714	0·850	0·88	238·7	140·0	1
0·993	1·045	0·94	312·5	183·8	2
0·923	1·049	0·88	308·4	181·4	1
			AVERAGE =	181·4	

AVERAGE A + B = 177·1 calories per square metre per hour.

TABLE III.—AVERAGE ENERGY EXPENDITURE IN CALORIES PER SQUARE METRE PER HOUR, USING THE THREE DIFFERENT TYPES OF STRETCHER SLINGS, ACCORDING TO :—

(*a*) *Subject.*

Type of sling	Subject A	Subject B	Average A + B
British	194·59	205·34	199·96
Polish	193·62	205·77	199·40
Experimental ..	172·15	181·12	176·40

(*b*) *Position in Squad.*

Type of sling	Position 1	Position 2
British	204·18	195·86
Polish	187·76	210·13
Experimental ..	168·47	184·82

TABLE IV.—ENERGY EXPENDITURE IN GRAMME CALORIES PER HORIZONTAL KILOGRAMMETER, USING THE DIFFERENT TYPES OF SLINGS.

Type of sling	Total load inclusive of body weight, etc., with bearers	Distance covered in metres	Average time in seconds	Kilogrammeters	Net cals. per minute	Net cals. per work period	Net cals. per sq. metre per minute	Net cals. per sq. metre per work period	Net cost in gramme cals. per horizontal kilogrammeter	Net cost in gramme cals. per sq. metre per kilogrammeter
British	221·22	108·86	102·0	24,082·01	4·539	15·404	2·596	8·826	0·640	0·367
Polish	221·22	108·86	98·57	24,082·01	4·497	14·774	2·572	8·450	0·613	0·351
Experimental	221·22	108·86	99·9	24,082·01	3·846	12·808	2·198	7·320	0·532	0·304

TABLE V.—INDICATING RESULT OF SPIROMETER EXPERIMENTS WITH THE THREE TYPES OF SLINGS UNDER TRIAL.

Subject	Normal spirometer reading	Reduction in spirometer reading with :— British sling		Polish sling		Experimental sling	
		Position 1	Position 2	Position 1	Position 2	Position 1	Position 2
A.	3,600	600	600	700	700	400	600
B.	3,800	500	600	600	200	800	400
C.	4,300	600	300	500	100	500	500
D.	4,400	700	600	900	700	500	500
E.	3,400	200	300	200	400	200	300
F.	4,000	200	400	400	500	500	700
G.	4,200	300	300	600	600	500	400
H.	3,500	400	700	300	400	300	500
I.	3,300	400	100	200	0	0	0
J.	4,100	200	700	400	500	500	500
K.	4,300	300	300	300	500	absent	absent
L.	4,100	200	300	400	300	100	0
M.	4,400	absent	absent	absent	absent	400	300
AVERAGE	3,954	383	433	458	408	392	392
		408		433		392	

Note.—Readings taken after carriage of patient for a fixed distance, in each case with a long rest between each experiment.

TABLE VI.—RESPIRATORY RATE PER MINUTE CARRYING LOADED STRETCHER AND USING DIFFERENT SLINGS.

Subject	Position	British	Polish	Experimental
1	1	29	31	25
2	2	18	20	21
3	1	31	37	26
4	2	34	27	27
5	1	17	19	20
6	2	30	31	30
7	1	26	26	26
8	2	25	26	26
9	2	25	25	25
10	1	25	26	24
	AVERAGE =	26·0	26·8	25·0

TABLE VII.—SUMMARY OF SUBJECTIVE SYMPTOMS.

Type of sling	Pressure	Constriction of chest	Comfort	Adjustment	Lifting stretcher	Lowering stretcher	Stretcher movement	Comparison in strain between Nos. 1 and 2
British	Severe and localized to nape of neck and front of axilla	Slight, due to sling. Marked owing to bent attitude in carriage. Breathing hampered	Discomfort amounting to pain in neck muscles. Tingling and numbness of forearm and hand	Very easy	Easy	Easy	Rocked to and fro	Strain on No. 1 much more marked than on No. 2
Polish	Moderate and more generalized. Over upper and mid-dorsal region of back and front of axilla	Marked, due to sling. Slight, due to attitude. Breathing markedly hampered	Discomfort in chest muscles. Very marked in No. 2	Complicated	Difficult	Difficult unless one arm first slipped out	None to speak of	Strain on No. 2 more marked than on No. 1
Experimental	Moderated and distributed over the upper dorsal region and shoulder	Slight, due to sling. None due to attitude which is erect. Breathing comparatively easy	No special discomfort except that due to the carriage of a heavy weight	Complicated	Difficult	Difficult, unless arm first slipped out	None to speak of	Strain a little more marked on No. 2 than on No. 1

THE MEINICKE MICRO-REACTION AS A CONTROL OF THE WASSERMANN TEST.

BY MAJOR H. T. FINDLAY,
Royal Army Medical Corps.

ELEVEN years ago the Wassermann reaction was described by the Medical Research Committee as "a weapon of astonishing precision" in the diagnosis of syphilis infection, and its continued employment at the present time is some indication of its value as a test. Since then, however, as the result of many systematic parallel comparisons between the Wassermann and the flocculation tests, the former no longer holds the position it once did. At the Third Conference on the Sero-Diagnosis of Syphilis held by the Health Section of the League of Nations, 1930, 966 samples of serum and 200 samples of cerebrospinal fluid were examined by twelve different methods of serological diagnosis, including seven modified Bordet-Wassermann techniques, with the result shown in the following table :—

Method	Syphilis. Percentage of positive reactions	Controls. Percentage of positive reactions	Controls. Number of positive reactions
Less than 1 per cent of Non-specific Reactions—			
Kahn's "presumptive" test (carried out by Professor R. L. Kahn, Ann Arbor, Michigan, U.S A.) ..	75·6	1·0	3
Muller's clotting test (carried out by Professor R. Muller, Vienna)	69·3	0·7	2
Kahn's "standard" test (carried out by Professor R. L. Kahn)	63·9	0	0
Modified Bordet-Wassermann test (carried out by Dr. A. Sordelli and Dr. J. M. Miravent, of Buenos Aires)	55·9	0	0
Modified Bordet-Wassermann test (carried out by Dr. E. J. Wyler, London)	54·4	0	0
Modified Bordet-Wassermann test (carried out by Dr. R. Scaltritti and Dr. J. Cassiniga, of Montevideo)..	49·9	0	0
More than 1 per cent of Non-specific Reactions—			
Modified Bordet-Wassermann test (carried out by Dr. T. E. Moreau, Montevideo)	64·7	13·9	42
Meinicke's (clarification) test (carried out by Dr. E. Dussert-Jolland, Santiago de Chile)	62·2	2·4	6
Modified Bordet-Wassermann test (carried out by Dr. J. Torraza and Dr. J. A. Lorenzo, Montevideo) ..	55·5	2·6	8
Modified Bordet-Wassermann test (carried out by Dr. A. de Assis, Rio de Janeiro)	54·9	4·3	13
Sero-hæmo-flocculation test (carried out by Dr. A. Prunell, Montevideo)	52·4	4·5	6
Modified Bordet-Wassermann test (carried out by Dr. P. Puppo, Montevideo)	45·4	5·6	17

It will be seen that Kahn's "presumptive" test heads the list, that the

Wassermann results vary considerably with the technique or modification employed, and that Meinicke's clarification test, although having more than 1 per cent non-specific reactions, is the best of those in that category. The higher percentage of positive syphilis reactions in the modified Bordet-Wassermann test immediately above it in the table is discounted by the large number of controls which were positive. The above results obviously constitute a good case for replacing the Wassermann by the Kahn, but information of some importance is lacking in the above abridged report, in that the relative numbers of sera from treated and untreated cases in the 966 sera which were examined is not stated. In short, did the Wassermann fail in early diagnosis or not?

It is generally agreed that it is mainly in treated cases that the Wassermann fails. For example, Dr. Osmond, with an experience of ten thousand Kahn tests, is of opinion that in early cases the Wassermann is as good as the Kahn, and that it is in treated cases that the Wassermann is beaten.

In military laboratories, and also in many others, the Wassermann test is the main sero-diagnostic method employed, and there is a natural reluctance to throw overboard a test of proved reliability provided a satisfactory technique is employed. The result has been the performance of duplicate tests, Wassermann and a flocculation test, as recommended by the Second Laboratory Conference of the Health Section of the League of Nations. In view of the duplication of tests thus entailed, it is desirable, if possible, to use as a confirmatory flocculation test one which does not take up too much time, provided it is sufficiently reliable to fill in the gaps the Wassermann has left. These will be almost entirely in respect of cases under treatment.

The Meinicke micro-reaction is a test which can be rapidly carried out. True, it is not so reliable as the macro-reactions Kahn or Meinicke. Ogden and Partner, in an analysis of 1,000 parallel Wassermann and Meinicke clarification reactions, found an agreement of 96·6 per cent, and produced evidence to show that the Meinicke tends to persist longer in treated cases than the Wassermann. They also carried out the micro test at the same time, and came to the conclusion that it was a useful rapid test, though not so reliable as the macro-reaction. If it is borne in mind, however, that a Wassermann control is wanted and then mainly of treated cases, the micro-reaction, on account of its rapidity of execution, serves a useful purpose.

The Meinicke micro-reaction was carried out on 1,514 sera sent for routine Wassermann test. The method adopted is certainly open to criticism in that it does not follow closely that of the author. The antigen suspension and sera were mixed by the drop method instead of by platinum loops; this was easier to do and, moreover, there was no need to economize with the sera to be tested.

REAGENTS.

Serum.—Is used uninactivated.

Antigen.—Is an ether-rest extract of beef-heart with the addition of about two per cent balsam of tolu.

Salt Solution.—0·03 per cent solution of pure sodium carbonate in 3·5 per cent sodium chloride. This is made from a stock 1 per cent sodium carbonate solution in 3·5 per cent sodium chloride.

The stock solution will keep for weeks if placed in a brown glass bottle with a well-fitting glass stopper. The 0·03 per cent concentration of sodium carbonate is best made up fresh for each batch of tests.

Preparation of the Antigen Suspension.—The antigen suspension is made by rapidly mixing the antigen with ten times the amount of salt solution after both have been brought to a temperature of 55° to 56° C. The salt solution is poured into the antigen, and the mixture is poured backwards and forwards five times rapidly and then allowed to ripen for exactly two minutes. It should be used without undue delay, and one suspension should not be used for more than ten or eleven tests. The suspension may be conveniently prepared by pipetting 0·1 cubic centimetre of the antigen into one series of small dilution tubes and one cubic centimetre of the salt solution into another series of tubes. All the tubes are then placed in the 56° C. water-bath and are ready for mixing in about five minutes. The mixing is done serially when required, as described later. With the small amounts of antigen used, the tubes should not be left in the water-bath sufficiently long for evaporation to occur.

Running the Test.—The required number of grease-free coverslips, numbered hollow-ground slides ringed with vaseline, platinum loops, spirit lamp, etc., are laid out. To facilitate placing the slides on the coverslips, it is convenient to place the latter on narrow wooden blocks.

One drop of each serum for test is dropped into a depression on a glass slab (squares of plate-glass with depressions, as used in the old Widal test, are useful). If these are not available, a piece of plate-glass on which grease pencil rings have been drawn can be substituted. When seven or eight sera have been dropped, the first antigen suspension is made as described above and allowed to ripen in the water-bath at 56° C. for exactly two minutes. By this time ten or eleven sera have been dropped. Using a dropper, six drops of the antigen suspension are dropped on to each drop of serum. The antigen suspension and serum are then thoroughly mixed with a platinum loop and a drop of the mixture is placed on a coverslip ; a hanging-drop preparation is made with the appropriately numbered slide. When ten or eleven preparations have been made, a further ten sera are dropped. A second suspension is mixed as before, allowed to ripen and the procedure repeated. A dropping pipette of No. 57 or 58 on the Starret-Morse gauge is a convenient size. If too large a dropper is used, it is difficult to ensure rapid thorough mixing of antigen suspension and serum. Care should be taken that the coverslips

are well vaselined down. Two or three platinum loops should be used, and after each preparation has been made the loop should be cleaned by an attendant by washing in alcohol, then in water and flaming. After use, the antigen pipette must be washed in alcohol to remove the tolu.

Reading of Results.—Preparations are set aside for one hour and are then read under the low power of the microscope after adjusting the diaphragm. *A negative reaction* shows no agglutination. The centre of the field is often a deep brown, fading to light yellow at the periphery, or it may be an even light yellow, according to whether the drop is spread out or not. Blood-corpuscles, particles of dust, etc., if present, are easily distinguished. *A positive reaction* shows definite agglutination of the particles often into a network with a white field between. If the preparation is examined by the $\frac{1}{6}$-inch objective, there is practically complete absence of Brownian movement in the field, whereas in the case of the negative reaction there is active movement.

Between the positive and negative reactions there are various gradations which at times are difficult to interpret. Examination by the $\frac{1}{6}$-inch objective helps.

Most strongly positive sera can be picked out naked-eye in the antigen-serum mixtures on the mixing plate and also in the preparations. As usual, gentle rocking assists flocculation. In the case of negative sera, the particles tend to clump in the centre on rocking the plate, but there is no clearing of the mixture as is seen in the positive preparations.

The microscope must, of course, be used for the final reading.

Results.

The results obtained are summarized as follows :—

Table I.

No. of tests	Absolute Agreement			Absolute Disagreement		Minor Disagreement			
	Positive	Negative	Doubtful	M + W −	W + M −	M ± W −	W ± M −	M + W ±	W + M ±
1,514	211	1,102	16	65	12	46	16	40	6

There was complete agreement therefore in eighty-seven per cent of the sera tested; the disparity between the two tests is, however, not so great as would at first appear, much of the disagreement being one of degree. There was absolute disagreement in seventy-seven, or 5·1 per cent of the sera tested. This is a considerable difference, but reference to Table II on page 18 will make it clear that by far the great majority of the discrepancies between the two tests occurred in respect of sera from cases of syphilis undergoing treatment; that the discrepancy was due to the Meinicke

remaining positive for a longer period in such cases was evident on reference to the case index cards.

TABLE II.

Type of Cases	Absolute Disagreements		Minor Disagreements			
	M + W –	W + M –	M ± W –	W ± M –	M + W ±	W + M ±
Syphilis cases under treatment	55	7	36	9	33	4
Undiagnosed cases	10	5	10	7	7	2

Included in the fifteen untreated cases in Table II, showing absolute disagreement, were ten undiagnosed venereal sore cases. Table III shows the results of serial tests in these.

TABLE III.

Number of cases	Wassermann	Meinicke	Date	Remarks
8	Negative	Positive	—	Both tests later negative without treatment of case
1	Negative	Positive	21.1.31	
	Negative	Positive	28.1.31	
	Positive	Positive	4.2.31	
	Strong positive	Positive	12.2.31	
1	Negative	Positive	2.5.31	
	Strong positive	Positive	16.5.31	

Note.—In the Meinicke, no differentiation was made between positive and strong positive reaction.

In seven of the eight cases, in which the Meinicke reaction was incorrect, the results were returned as "medium positive" and, though neither incomplete nor doubtful negatives, they were definitely weakly reacting positives.

The remaining five untreated cases showing complete disagreement were:—

Acute Yellow Atrophy.—Serum was obtained post mortem. The Wassermann was strong positive; Kahn negative, Meinicke negative. The tests were repeated one week later on the same specimen with the same result.

Lightning Pains.—The Wassermann was strong positive and Meinicke negative. Both tests were subsequently negative without treatment.

Periostitis.—Wassermann strong positive, Meinicke negative. Repeated Wassermann strong positive, Meinicke test not done.

Ulcer, Nose.—Meinicke positive, Wassermann negative.

Iritis.—Wassermann negative, Meinicke positive.

Serum for further tests could not be obtained from the last two cases.

The macroscopic test (Meinicke clarification reaction) was carried out on 140 sera parallel with the Wassermann. There was complete agreement in 114 (positive 28, negative 86).

Twenty-five of the twenty-nine disagreements occurred in sera from cases under treatment, in all of which the Meinicke was positive and the Wassermann negative.

Conclusions.

(1) The Meinicke micro-reaction provides a useful rapid control of the Wassermann test, particularly in regard to cases of syphilis under treatment, in that the test remains positive for a longer period than does the Wassermann.

(2) It is not sufficiently reliable (at any rate as carried out in the method described) to be used alone in the sero-diagnosis of syphilis, as weakly reacting positive results are not entirely trustworthy.

References.

[1] 1920. Medical Research Committee, Special Report Series No. 47.

[2] 1930. Report of the Third Serum Conference, published by the Health Section of the League of Nations.

[3] Osmond, T. E. *Brit. Journ. Ven. Dis.*, 1931, vii, 98.

[4] Ogden, W., and Partner, F. *Lancet*, 1931, ccxxi, 121.

[5] Instructions issued by Messrs. W. Bredt, Ltd., Great Tower Street, London, with supply of Meinicke antigen.

[6] Meinicke. "VIIIe Congrès International de Dermatologie et de Syphiligraphie," August, 1930.

HISTORY FROM HOLLYWOOD.

By I. A. F.

Mr. Ginwala Athabhoy, the manager of the Waldorf, the best and biggest cinema in our cantonment, was good enough to give us a free show in aid of our local branch of the British Legion. Bob arranged it. "What we want, Mr. Athabhoy, is a first-class talkie with a special appeal, and 'Regimental Property' is *the* thing, I hear. It's all about de Crespigny's Dragoons, the old name of *our* regiment, Mr. Athabhoy. You see we were raised in the Civil War, so *esprit de corps* alone will fill the house; an 'all hands' parade, in fact." Mr. Athabhoy said he would do his utmost to procure the film. He did not realize that *esprit de corps* is a plant which requires more delicate handling than America's film magnates are wont to employ. *Esprit de corps* is closely linked with *amour propre*, and the result of Mr. Athabhoy's efforts and Bob's thoughtlessness provided a good illustration of this fact.

As soon as Mr. Athabhoy announced that the talkie had been secured ("all the way from Bombay") the enthusiasm of the troops was worked up and seats were reserved by a Governor-General and his gracious chatelaine, by a General Officer Commanding-in-Chief and his staff, and by brigadiers, colonels, majors, and a host of smaller fry.

The great night came, and we assembled prepared to enjoy the film despite the sartorial restrictions of mess kit. The military were in force headed by the *N*th Dragoons, and we were thus saved the common humiliation of seeing ourselves travestied and debased on the screen before a multitude of appreciative Indians.

The music machinery pumped out "The Stars and Stripes," a wild West voice—also mechanical—announced the advent of "Regimental Property," in five reels, and the screen told us that the "Property" was a well-known Hollywood belle. No doubt the senior officers expected a glimpse into the home life of old Colonel Rupert de Crespigny. Possibly the juniors, more sophisticated, hoped to detect "the old man" in the act of "telling the tale." In this happy and optimistic atmosphere the entertainment began. It was not our fault that gloom pervaded its ending.

War!

Roundhead *versus* Cavalier!

Colonel Rupert de Crespigny's regiment ("de Crespigny's Dragoons") was seen on the line of march.

It was a fine martial picture, and beautifully coloured. We admired the attractive uniforms, accoutrements and saddlery, and we sighed for

those picturesque days before that grim war which has condemned us all to perpetual khaki. We liked the horses too; they had the air of Mr. Bertram Mills' Christmas Circus at Olympia.

H.E. the Governor-General and the G.O.C.-in-C. reclined in their chairs, pleased and appreciative. The "other ranks" leaned forward and reckoned that bootboys and syces must have been cheap in those days.

It was plain that Colonel de Crespigny was a *beau sabreur*. He headed the cavalcade and was mounted on a long-tailed, bushy-maned, cream-coloured charger. His raiment was gorgeous. His features were handsome, but marred by a somewhat sinister expression, and his bearing was of the devil-may-care order. We guessed him to be a man possessed of more courage than conscience, a lovable scoundrel, mayhap. For that reason we were not inclined to be unduly critical, until the gallant Colonel suddenly burst into song, and beat time by waving his right hand in a manner unknown to the best musical circles. His example was infectious, for his dragoons also gave tongue and followed suit with the hand-waving business.

In the darkness the Colonel of our own regiment of dragoons was heard to guffaw. The ladies tittered. A husky voice with an authoritative ring (spotted as belonging to Squadron Serjeant-Major Thomas Bloggs) declared, "It's no the kurnul at all, it's the b——y bandmaster." "You're wrong," someone else shouted, "it's a —— flag waggin' mounted parade." A few more ribald remarks from the rude soldiery, and the excitement died down, momentarily, at least.

The song bore a remarkably close resemblance to the popular marching song from "The Vagabond King." No matter, it enabled us to recognize light musical comedy, and so prepared us cheerfully to acquiesce in the impossible.

De Crespigny, still singing and beating time, directed his lyrical dragoons on the main gates of a grand old castle. Here the regiment formed line, halted, and remained in the saddle until the song was finished.

Without warning we were dumped into the bridal chamber of Sir John Psalter and his newly-wedded wife, the lovely Prudence. A furtive glance at the screen showed us that the enamoured couple were unaware of our presence, they did not even hear the distant chant of the royalist dragoons, they were on the point of consummating their recent marriage.

We felt uncomfortable.

Happily, the situation was saved by a "cut" made by the Bengal Board of Film Censors who must have turned up just in the nick of time. The occupants of the best seats sat tight and said nothing, but the rest of the audience was vastly amused and made no bones about it.

The film rolled on.

As the last bars of the borrowed melody rose and fell, Sir John drew aside the curtains and looked out of the window.

Prolonged, emotional "close up" registering rage, fright, desperation, despair.

At last urged by the terrified Prudence, the Puritan baronet fled.

The next "shot" took us back to the main gates. "Dismount!" The dragoons fell in, in line, and their chargers ambled off, apparently unattended: a superb piece of horsemastership. A wag in a front seat started singing—

> Come to the stable as soon as you're able
> And water your horses and give them some corn.

We all joined in—

> Water your horses and give them some corn,
> Or else you will wish you had never been born.
> Come to the stable as soon as you're able
> And water your horses and give them some corn.

However, the old call, though sung with a will, produced not the slightest effect on de Crespigny's Dragoons: they were still standing fast, unmindful of their horses, when we were suddenly switched back to the bridal chamber. Prudence was crouching in a corner gazing towards the door. The door swayed back and forth in an uncanny, drunken fashion, and then burst open to admit Colonel Rupert de Crespigny. His entrance was more precipitate than dignified, so that his "Where is the damned rebel, Sir John Psalter?" fell rather flat. Somebody in the audience replied, "In the guard-room!" but in the meantime de Crespigny had caught sight of Lady Psalter. His chest heaved like a monsoon swell in the Indian Ocean, the veins stood out on his forehead like newly-hatched snakes, his eyelids contracted to mere slits and his mouth twisted into grimaces as lewd as they were sickly. He licked his chops and sprang forward with the strength and purpose of a beast of prey. One half of the audience shouted "Half time!" "Foul!" "Send for the referee!" The other half prayed for the early return of the Bengal Board of Film Censors.

The struggle was fierce and long drawn out, for Prudence put up a magnificent resistance. Just as the Colonel was on the verge of winning, his adjutant—another nasty looking rake—hurried in with the announcement that "a Puritan guy" had been caught lurking in the shrubbery. "Shoot him!" bellowed de Crespigny. The adjutant saluted and withdrew, a shot rang out, and that was that.

This welcome interruption had given Lady Psalter the chance of escaping from the room. When de Crespigny discovered that she had fled, he adjusted the corner of his tunic, smoothed his ruffled locks, smiled (" close up" of a horrible smile) and ordered dinner to be served.

The next scene depicted the banquet hall of Castle Psalter.

De Crespigny's Dragoons, headed by their precious C.O., marched in to a quickstep which would have turned any light infantry green with envy.

They were followed by a bevy of ballet dancers who, *en route* to Covent

Garden, had broken their journey at the castle. No doubt their charabanc had run out of petrol. Their advent was opportune, since each dragoon was now provided with a suitable partner.

The dinner was of the wine, women and song type. It was a huge success; but where all the food and drink came from at such short notice, goodness only knows. Towards the end of the banquet a select party of ballerinas danced a hair-raising tango on top of the dining table. Part of this item, too, was "cut" by the Bengal Board of Film Censors, whose vigilance once more earned the gratitude of the dress circle.

The shrubbery must have been a sort of Puritan bran pie because, at this juncture, the adjutant caught a second "guy" in hiding. The latter was dragged into the hall and told by the Colonel that, if he did not sing a good song, he would be shot forthwith. Luckily the poor fellow had a fine voice, and his song delighted everyone. He was on the point of being dismissed with a hearty kick when somebody denounced him as the rebel leader, Sir John Psalter. This prize was, of course, a gift from the gods. De Crespigny, who had drunk as much champagne as would float the battleship *Baltimore*, gave orders that Sir John should be placed before a firing party at 8 o'clock on the following morning.

There followed a distressing scene with numerous "close ups." Poor Prudence begged and prayed for her husband's life. The sensual dragoon laughed at her agony and told her that Sir John's life would be spared—on one condition.

Remembering that this was a Hollywood film dealing with a licentious soldiery, it is easy to guess what that condition was.

And so the wretched story dragged on. It would be wearisome to describe how Lady Psalter's virtue triumphed in the end, and how the film finally faded out as the dragoons rode off singing and still beating time. One incident, however, deserves special mention: when the Colonel bade farewell to Prudence, he said :—

"Wall, honey, I guess yew larned somethin' last night. Yew larned how soldiers behave in war time, eh?"

Think of it?

To the honour and glory of our cantonment, this speech was loudly and bitterly objected to. Indeed, it nearly caused a riot.

Afterwards, in the clubs and messes, a few tactless souls tried to make capital out of the early history of our cavalry unit; but the attempt did not endure: an *N*th Dragoon proved to be unduly sensitive when addressed as "Rupert." Nor, in the institutes and bazars, did the rest of the troops derive much enjoyment from greeting the cavalrymen with "Oh! Listen to the band," for this harmless little ditty invariably led to a more or less serious scrap.

We netted five hundred rupees for the British Legion; but it is unlikely that "Regimental Property" will ever again be screened in our cantonment.

A DEMONSTRATION OF A CASUALTY CLEARING STATION (INDIAN ESTABLISHMENT).

By Major T. B. NICHOLLS,
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One of the great obstacles to field training of officers of the Royal Army Medical Corps is the fact that the units they have to handle in war do not exist in peace time.

Again, it is difficult to visualize from mobilization tables and lists of equipment exactly how the personnel and material are to be employed. One sees a certain number of men included in the tables, but there is considerable difficulty in knowing to what departments of a unit they would be detailed and how many men would be required for each task.

Last year the Southern Command Exercise, India, included the demonstration of a Casualty Clearing Station, principally for the instruction of staff officers and others attending the exercise, and the opportunity was taken of instructing R.A.M.C. officers in the organization of the unit. All R.A.M.C. officers in the Poona (I) Brigade Area were employed in staffing the Casualty Clearing Station, and other officers, particularly those who were proposing to sit for promotion examinations, attended from districts of the Southern Command.

The demonstration was arranged so that the full tentage was drawn and erected in order that the camping space and the general appearance could be seen, and sufficient equipment was obtained to give a general idea of the working of the unit.

The following personnel were detailed for the demonstration of the Casualty Clearing Station, held on November 18, 1931. They were also required on the 17th, in the afternoon, for a rehearsal.

It was assumed that one surgical team was detailed from a unit in a quiet sector to assist in this Casualty Clearing Station. So the numbers detailed were larger than those shown in War Establishment, India.

(1) Officers R.A.M.C., 5. I.M.S., 4.

(2) I.M.D.: (*a*) Assistant surgeons, 4. (*b*) Sub-assistant surgeons, 6.

(3) R.A.M.C.—Serjeant, 1; privates, 9; and 1 for X-ray.

(4) Indian Hospital Corps: (*a*) Clerical Section: Havildar, 1; Sepoy, 1; (*b*) Stores Section: Havildars, 2; Naiks, 3; Sepoys, 3. (*c*) Ambulance Section: Havildar, 1; Naiks, 2; L/Naiks, 4; Sepoys, 43; total = 50. (*d*) Nursing Section: Havildar, 1; Naiks, 1; Lance Naiks, 2; Sepoys, 12; total = 16. (*e*) General Section: (i) Head cook, 1; 2nd Grade, 7; total = 8; (ii) Bhisties 8; (iii) Dhobies, 8; (iv) Ward servants, 8; (v) Sweepers, 12.

(5) Dental Centre: Officer, 1; Clerk Orderly, 1.

In addition, one medical officer was required to handle the four cars representing the M.A.C. and to dress and label forty casualties which were to be put through the Casualty Clearing Station.

The distribution of the personnel is shown in the following table :—

TABLE SHOWING SECTIONS OF THE CASUALTY CLEARING STATION AND PERSONNEL IN EACH.

1. *Officer Commanding's Office.*	
Commanding Officer	1
Havildar Clerk	1
Naik, Ambulance Section, O.C's Orderly	1
Total	3
2. *Quartermaster's Department.*	
Havildars 2 (1 i/c stores and clothing, 1 i/c rations)	2
Naiks 2 (1 i/c pack stores)	2
Sepoys 3	3
Total	7
3. *Dispensary.*	
Sub-Assistant Surgeon	1
4. *Medical Stores.*	
Sub-Assistant Surgeon	1
5. *Stretcher Dump.*	
Naik 1 ; Ambulance Section	1
6. *Guard.*	
Naik 1 ; Sepoys 3 ; Ambulance Section ... Total	4
7. *Ambulance Unloading Post.*	
Havildar 1 ; Stretcher Squads 5 ; Ambulance Section ... Total	21
8. *Reception Tents.*	
Medical Officer R.A.M.C.	1
Sub-Assistant Surgeon	1
R.A.M.C. N.C.O.	1
R.A.M.C. Private	1
Clerical Sepoy	1
Ambulance Section (L/Nk. 1 ; squads 2)	9
Nursing Section. Havildar	1
Cook for Buffet	1
Bhisti	1
Ward Servant (for Buffet)	1
Sweepers	1
Total	19
9. *Minor Dressing Tent.*	
Medical Officer I.M.S.	1
Assistant Surgeon	1
Private R.A.M.C.	1
Sub-Assistant Surgeon	1
Nursing Section (L/Nk. 1 ; Sepoys 2)	3
Bhisti	1
Sweepers	1
Total	9
10. *Pre-operation Wards.*	
Medical Officer R.A.M.C., also i/c X-ray Department	1
Assistant Surgeon	1
Private R.A.M.C.	1
Nursing Section Sepoys	2
Sweeper	1
Total	6

11. *Theatre.*

Officers R.A.M.C.: Surgeon 1; Anæsthetist 1	2
Officers I.M.S.: Surgeon 1; Anæsthetist 1	2
R.A.M.C.: Private, O.R.A., 1; Privates, Surgical Teams, 2	3
Ambulance Section: L/Nk. 1; squads 3	13
Bhisti (also for Pre-Operation Ward)	1
Sweeper	1
Total	22

12. *Surgical Division.*

Medical Officer I.M.S.	1
Assistant Surgeon	1
Sub-Assistant Surgeon	1
R.A.M.C. Privates	2
Nursing Section: Nk. 1; Sepoys 4	5
Bhisties	2
Ward Servants	3
Sweepers	3
Total	18

13. *Medical Division.*

Medical Officer R.A.M.C.	1
Assistant Surgeon	1
Sub-Assistant Surgeon	1
Private R.A.M.C.	1
Nursing Section (L/Nk. 1; Sepoys 4)	5
Bhisties	2
Ward Servants	3
Sweepers	3
Total	17

14. *Dining Hall.*

Ward Servant (Bhisti from Medical Wards)	1

15. *Bathing Tent.*

(Bhisti from Surgical Wards).

16. *Kitchen.*

Head Cook	1
Second Grade Cooks	6
Bhisti	1
Sweeper	1
Total	9

17. *X-ray Department.* (Not authorized in War Equipments, India).

Medical Officer (also in Pre-Operation Ward)	—
X-ray Orderly (also in Pre-Operation Ward)	1

18. *Dental Department.*

Dental Officer (to assist in minor dressing or theatre if necessary)	1
Clerk Orderly (to assist in minor dressing or theatre if necessary)	1
Total	2

19. *Latrines.*

Sweeper	1

20. *Dhobi Ghat.*

Dhobies	8

A demonstration of the handling of patients was made with patients about to undergo the various treatments appropriate to their cases in the several departments. The operating theatre was so realistic that certain non-medical officers had to be led outside on seeing a patient on the table with the surgeon just on the point of performing a laparotomy.

To assist those attending, a type plan of the lay-out of a Casualty Clearing Station was prepared, also a list of personnel as employed on their

various duties, and an extract of standing orders of the unit, showing how patients were to be received, classified, treated and disposed of.

The Indian Casualty Clearing Station differs very greatly from the Home Casualty Clearing Station in many very important particulars, as it is primarily designed for service on the N.W. Frontier, where communications are not good.

Field Service Regulations, Vol. I, Additions for India, 1930, para. 118, lays down that "In India a Casualty Clearing Station is an immobile unit, and has no transport."

It has also no Nursing Sisters and fewer medical officers than the one at home, and its equipment is very much less.

It is realized that the equipment laid down was conditioned by the state of communications on the N.W. Frontier, but as the unit is immobile and will almost certainly be sited on one of the main roads of the frontier, or at a rail head, it would seem that the possibility of adding further equipment to make the unit more efficient should be considered.

The type plan, standing orders, and some notes on the Casualty Clearing Station are appended in the hope that they may be of service to officers studying for their promotion examination. It is to be noted that gas casualties are not provided for in the type plan. It should be realized that this was drawn up principally for the instruction of non-medical officers, and would probably have to be altered considerably as the result of experience in a campaign.

Notes on the Casualty Clearing Station for India.

(See Field Service Regs., 1930, para. 118, & R.A.M.C. Training, paras. 255, 259 and 409.)

1. *Mobilized* at one per Division. They are Army Troops and not under the control of either Corps or Division.

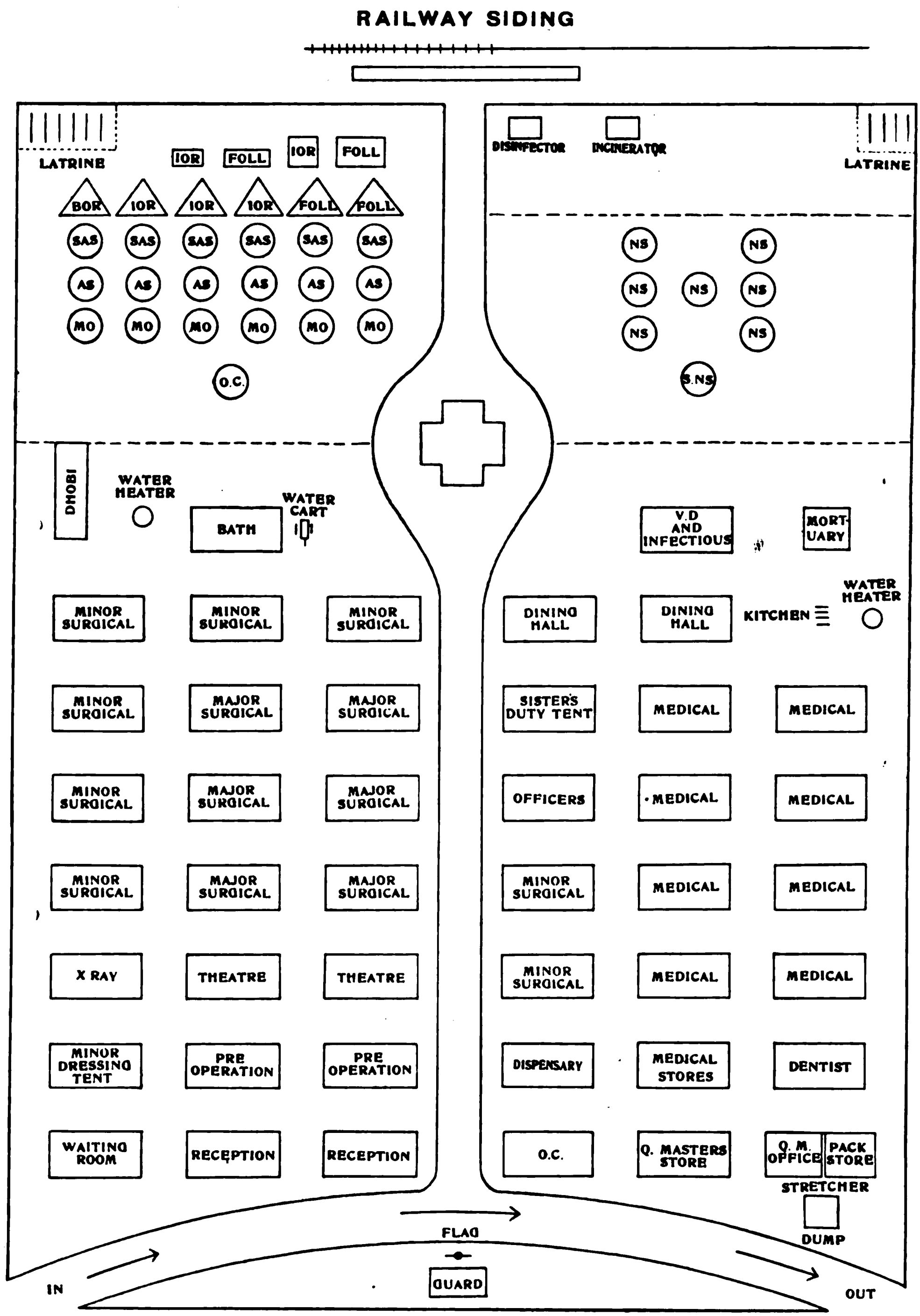
2. *Personnel.—War Establishment* (*India*).

Medical Officers..	7	British 21
Assistant Surgeons	4	
R.A.M.C.	10	
Sub-Assistant Surgeons	6	Indian 137
I.H. Corps	75	
Followers	56	
Total		158

Army Dental Corps.—1 Officer, 1 British Other Rank as decided by A.H.Q.

Q.A.I.M.N.S.—Not shown in War Establishments, India.

3. *Function.*—It is the pivot of the whole system of evacuation and is the first unit behind the front line which can provide full surgical treatment and hospital accommodation for the seriously wounded. (R.A.M.C. Training, para. 409.)



TYPE PLAN OF A C.C.S.

4. *Location.*—(*a*) Camp space 250 × 150 yards. (*b*) 1,200 yards from railway junction, park or dump. (*c*) 500 yards from main line of railway. (*d*) Connected by lightrail way or trolly line; or, if practicable, a special siding to be constructed for ambulance trains connected with the main line. (*e*) Good road for motor transport. (*f*) Ample water supply. (F.S.R., para. 118.)

Will frequently be grouped, so that one Casualty Clearing Station can be receiving while another is evacuating. Surgical teams are sometimes sent from other medical units in times of pressure. (R.A.M.C. Training, paras. 255 and 257.)

5. *Transport.*—Is a unit that has no transport.

If required to move, application is made for M.T. from "Q."

6. *Capacity of a Casualty Clearing Station* (*India*).—200 patients, but can be expanded to take many more.

EXTRACT FROM STANDING ORDERS, NO. UMPTEEN CASUALTY CLEARING STATION. BY MAJOR T. B. NICHOLLS, O.C., R.A.M.C.

I. Admission of Casualties.

(1) On arrival of ambulances at the unloading post, the N.C.O. i/c unloading party will cause all cases to be taken to the reception tent.

(2) After unloading, the ambulances will proceed to the stretcher dump where the orderly will draw the same number of stretchers, blankets, hot-water bottles, splints, &c., as were handed in with the patients.

II. Reception Tent.

The medical officer in charge will classify the casualties as follows and dispose of them as under :—

(*a*) *Walking Cases.*

These will be directed to either the minor dressing tent or to the medical wards.

(*b*) *Stretcher Cases.*

(1) Minor wounds :—

To minor dressing tent.

(2) Serious wounds not requiring immediate operation :—

Direct to surgical wards.

(3) Serious wounds requiring immediate operation and those cases that are collapsed :—

To the pre-operation wards.

(4) Medical cases :—

To the medical wards.

(*c*) *Infectious Cases.*

To be sent immediately to the infectious wards.

(*d*) *Venereal Cases.*

To venereal wards.

(1) The medical cases will either walk or be carried to the appropriate medical wards. The infectious and venereal disease cases will be immediately transferred to their appropriate wards.

(2) The particulars and diagnosis of each case will be entered by the clerk in the A. and D. books.

(3) All patients fit to receive them will be given hot drinks, sandwiches and cigarettes while awaiting attention.

III.—Minor Dressing Tent.

All wounds will be dressed and anti-tetanus serum given, if this has not already been done in the field ambulance. Care should be taken to see that the presence of a tourniquet is not overlooked.

After attention the wounded should be directed to the minor surgical wards.

IV.—Pre-Operation and Resuscitation Ward.

(1) Those cases requiring an operation will be prepared for it and their clothing changed for pyjamas. The clothing will be handed into the pack-store and a receipt obtained and handed to the patient. Patients' valuables will be placed in small bags which will be handed to the patients.

(2) Those requiring resuscitation will be revived either with the hot-air warming apparatus, saline infusions, or by any method which may be necessary to suit the individual case.

V.—Theatre.

All operations will be done here after the use of X-rays if necessary. After operation the cases will be carried to the major surgical wards, avoiding exposure en route.

VI.—Surgical Wards.

(*a*) *Major* Surgical: For after-care of operation and serious cases. Those who have not been through the theatre will be changed into pyjamas and their clothing handed into pack-store and a receipt obtained.

(*b*) *Minor* Surgical: For the after-care of minor cases. If any such cases become worse they will be transferred to the major surgical wards.

VII.—Medical Wards.

(*a*) Major: Patients to be changed into pyjamas.

(*b*) Minor: For less serious cases some of which may have to be later transferred to the major wards.

VIII.—Infectious Wards.

The usual precautions for infectious cases will be observed.

IX.—Evacuation.

The ambulance train will arrive on the spur line at 12.00 hours daily.

Medical officers will classify patients who are fit to be evacuated in time for them to be ready to be moved by 11.00 hours.

X.—Rations.

Will be drawn at the rail head from rail head supply detachment at Hardapsur (Indents on I.A.F. F.1024) at 16.00 hours.

Enough rations and medical comforts will be kept in reserve to deal with an unexpected influx of casualties.

XI.—Medical Stores.

Will be drawn from No. 1 Advanced Depot of medical stores.

XII.—Returns.

See Field Service Regulations, pp. 356—366.

The following returns will be rendered :—

(1) I.A.F. W. 3006 :—Daily Strength Return to Officer i/c 2nd Echelon.

(2) A.F. W. 3015 : Daily Hospital Return (casualties) to the officer i/c 2nd Echelon and War Office.

(3) A.F. A.36 : Nominal roll of patients in hospital. Weekly to 2nd Echelon and War Office, and officer i/c Home Records.

(4) A.F. A.36 : Daily to units concerned.

(*Note.*—This not a complete list of returns).

DENTAL SICK-WASTAGE ON ACTIVE SERVICE.

By Major D. CLEWER,
The Army Dental Corps.

UNDER present peace conditions dental sick-wastage gives little cause for concern, whereas in war it may develop into a subject of considerable anxiety to administrative medical officers and others responsible for maintaining the effective strength of a fiеld force.

The writer cannot recall any reference to the problem in the many appreciations of medical situations published in recent years, and hopes therefore that it may be a subject of fresh interest to medical and dental officers.

It is suggested that dental disorders are of the utmost importance as a potential source of wastage of man-power on active service, in view of the fact that 41·80 per thousand of the ration strength of the British troops in France were admitted to hospital for "Diseases of the Teeth and Gums" alone during the year 1915—the average time in hospital being 4·9 days for officers and 7·5 days for other ranks.

This high ratio was due to three main causes: (1) The inadequate number of dental officers allotted to the force; (2) the mobilization of reservists in poor dental condition; and (3) the posting to the force of reinforcements who had had little or no dental treatment.

It should be noted that the above figures are merely those of admissions for purely dental reasons, and it follows that a further large number of men must have been admitted on account of general disorders which were primarily of dental origin.

Seen in this perspective the sum total of the dental sick-wastage presents a rather alarming picture.

The mobilization of reservists or the embodiment of the Territorial Army must inevitably result in an influx of men of low dental standard, and a high admission rate for dental and general disorders is therefore to be expected at the outset of any future campaign; another serious factor is the high percentage of reservists who will require the provision of dentures or who will be already in possession of dentures which will subsequently require repair.

The experience of 1915 was preceded by that of the South African War, during which 2,274 cases had to be invalided overseas on account of "Diseases of the Teeth and Gums," and was confirmed by that of the Shanghai Defence Force, 1927, where the reservists were again found to be in poor condition, and where the amount of necessary denture work rose to high proportions.

As a result of previous experience it would therefore appear that full information as to the numbers and age-groups of reservists to be called up is likely to be of value in the preparation of the medical appreciation of the situation at the commencement of the campaign.

That wastage can be effectively controlled by the provision of an adequate establishment of dental officers in the field is shown by the fact that the appointment of a relatively small number of dental officers to the British Expeditionary Force reduced the dental admission rate from approximately 40 per 1,000 in 1915 to approximately 10 per 1,000 in 1918.

These figures are still more striking when it is realized that men of lower physical standard were being accepted and that Vincent's infection of the gums and oral mucous membrane was prevalent during the latter years of the Great War.

The question of denture work also gave rise to much anxiety in France where some 100,000 dentures were supplied during the year 1917, the majority of the cases having to be evacuated to the base.

The establishment of large dental laboratories in army areas was recommended by dental officers and, when adopted in the autumn of 1917, proved to be of the greatest value, as it is estimated that from that time until the Armistice over 12,000 men were kept effective in army areas and were therefore available as first reinforcements in time of emergency.

Apart from casualties of a purely dental nature, the profound effects of dental sepsis upon general pathological conditions are now so widely recognized that any shortage of dental personnel would have a disastrous effect upon the health of troops in the field or in training.

It is also suggested that in the event of general mobilization medical and dental administrative officers are likely to be confronted with the problems of: (1) The immediate provision of the dental personnel required for the needs of the Territorial and New Armies. (2) The provision of sufficient dental officers and dental mechanics in front areas to ensure that every possible dental casualty is treated and returned to duty without admission to hospital. (3) A consideration of the probable dental condition of reservists with a view, if thought necessary, to the provision of dental personnel in excess of normal war establishment. (4) The provision of facio-maxillary centres in accordance with the expected nature of the campaign, having in mind the fact that heavier casualties with a higher proportion of facial wounds are to be expected in positional warfare.

In conclusion, it may be well to call attention to an error in the "Casualties and Medical Statistics" volume of the "Official History of the War," more especially as it is a work which is likely to be the standard work of military medical reference for all time.

In Table 19, on page 143, the ratios per thousand of admissions to hospitals for "Diseases of the Teeth and Gums" are shown as 41·80 per 1,000 for the British troops in France, 1915, and as 32·2 per 1,000 for the British Army at home and abroad, 1927.

The actual figures for 1927 were 2·2 per 1,000—a ratio which affords striking proof of the value of an organized dental service in the prevention of sick-wastage, and which demonstrates how closely the subject may concern the administrative officer in war.

RECENT RESEARCH WORK IN DEEP SEA DIVING.[1]

By Surgeon Lieutenant-Commander A. E. PHILLIPS, M.B., R.N.

The British Admiralty continues to place reliance in the rubber diving suit, and for the past three years, in collaboration with Messrs. Siebe, Gorman and Co., has been conducting research and practical experiments in deep sea diving, both with the rubber suit and with the German all-metal suit.

When one considers the objective of deep sea diving, which is equally the saving of life in a sunken submarine and the recovery of sunken trophy, it will be seen that the cumbersome all-metal suit has distinct disadvantages. Although allowing certain work to be carried out at a greater depth than can even now be obtained in a rubber suit, its comparative immobility and the difficulty in keeping its joints water-tight preclude its use in the rapid work necessary for saving lives entombed in a disabled submarine.

A similar dress is used by the Italians in their endeavour to recover bullion from the "Egypt," but it has no legs and is used purely as an observation chamber, the diver telephoning the instructions necessary for placing grabs and demolition charges.

Let us turn to the rubber diving suit, and the methods employed in the British Navy for diving between 200 and 300 feet, a depth where much useful salvage can be carried out.

As the diver descends he is subjected to increasing water-pressure, which is transferred to the air in his suit, and hence to the air in his lungs. This increased alveolar pressure causes a corresponding increase in the amount of the gases in the body. The pressure of abnormal amounts of nitrogen in the body causes no inconvenience as long as the gas is in solution, but should the pressure be released too rapidly for the gas to escape through the lungs, bubbling occurs. A bubble in its action resembles an embolus and is the cause of caisson disease—the bugbear of all who work under increased air pressure. An increase of oxygen or carbon dioxide would cause poisoning. The amount of oxygen necessary to produce oxygen poisoning is not completely defined, but experiments on animals are now in process.

Should the diver be brought too rapidly to the surface, bubbling of nitrogen will cause caisson disease. The prevention of this has been known since the days of Paul Bert. It suffices to reduce the pressure gradually by bringing the diver up slowly, this being known as decompression. The present Admiralty Tables were drawn up as a result of the work of Professor J. S. Haldane, Professor A. E. Boycott, and Captain G. C. C. Damant, R.N., for the Admiralty Committee of 1907, and are used all over the world with most successful results.

These tables were calculated for a maximum depth of 204 feet, and a maximum stay on the bottom of one hour, or in an emergency for one hour and fifty minutes.

Now the time taken in bringing to the surface a diver who has been working at a depth of 204 feet for one hour, is 124 minutes, implying a considerable waste of

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[1] A paper read before the United Services Section of the Royal Society of Medicine on December 14, 1931, and reprinted by kind permission.

working time, and a considerable feat of endurance when it is considered that he is hanging on a rope suspended in mid water, often in winter, or even in our summer, at a temperature of 40°—50° F., and in a strong tideway. To overcome this difficulty, Mr. R. H. Davis, Managing Director of Siebe, Gorman & Co., has designed and produced a steel chamber which, when submerged acts as a diving bell, and when closed as a decompression chamber. The Davis Submersible Decompression Chamber is lowered to the depth at which it is required to pick up the diver. It is fitted with "Salvus" oxygen breathing apparatus, depth and pressure gauges, thermos flask containing hot coffee, etc. This chamber was designed: (1) for the greater safety and comfort of the diver; (2) to enable him to use oxygen breathing apparatus to accelerate decompression; (3) to work at greater depths for longer periods; and (4) to be brought up immediately and safely to the surface in emergency. Oxygen breathing permitted by this chamber shortens the time of decompression by a half to a third and materially adds to the possibility of successful diving at depths of over 200 ft.

The importance of the use of oxygen in decompression, originally advocated by Paul Bert, has been recognized by physiologists who have followed him, and confirmed by Sir Leonard Hill and others who have carried out research on the subject.

In the months preceding the 1931 diving trials, Mr. R. H. Davis arranged for Captain Damant to calculate a new set of decompression tables to a depth of 300 ft. on Professor J. S. Haldane's system, taking into consideration five groups of tissues saturating at different rates and allowing for the accelerating effect of oxygen breathed from a certain point in the decompression scales. Mr. Davis placed his experimental plant and other facilities at the disposal of the Admiralty. Several hundred tests of these tables were made on goats, and it was found necessary to increase the safety factors largely (the system of calculating remaining the same). Eventually a decompression table was produced which had been thoroughly tested over the range in which the men were to dive, and the success of the deep water trials described below was largely due to this careful preparatory work.

What knowledge have we gained by the work of the last few years?—(1) Deep diving has emerged from the chrysalis stage. Investigations are still proceeding and much remains to be done, but sufficient knowledge has been gained to permit preparations for the routine training of a proportion of our divers in deep sea work. It is hoped that later on deep sea diving sections will be attached to our principal fleets.

(2) Oxygen breathing during decompression and the D.S.D.C. have made diving safer, and the time spent during decompression more comfortable. It has also effected a saving of from a third to a half of the time in decompression—a valuable gain now for the diver and the officer in charge of the salvage.

(3) Diving, and working at a depth of 300 ft. in a rubber suit, is both safe and practicable. One of our divers reached a depth of 344 ft. and came to the surface as one might return from an afternoon walk.

The use of oxygen in deep diving.—The intensive use of oxygen is viewed with mingled feeling in modern medicine, for while it confers many undeniable benefits, it is responsible under certain conditions, such as prolonged exposure, for undesirable poisonous effects.

In animals, exposure to 45 lb. pressure of oxygen quickly leads to convulsions, and

as the pressure rises, the quicker is the onset and the more likely is pneumonia to supervene. With mice and rats the convulsion period is preceded by extensive washing operations, which after a time, depending on the pressure, change into running convulsions. These last a few seconds and are usually succeeded by a period of inactivity When the pressure is reduced convulsions are again noticeable, often even if no previous convulsions have occurred.

A few minutes' exposure to a 100 lb. pressure of oxygen produces severe convulsions in the smaller animals.

Exposure to 45 lb. and under takes longer to produce toxic effects, mice convulsing in about 20 minutes. At the end of 30 minutes two rats had shown no symptoms, as was the case with two monkeys. 40-45 lb. seems to be near the critical pressure for animals; below this they are fairly safe, except that during long exposure they appear to go into a stupor; over 45 lb. they are much more liable to convulsions and pneumonia.

Luckily we have no cases of oxygen poisoning to record among the divers; even allowing for the use of oxygen during decompression we have a safe margin.

We have found in our limited experience with oxygen (1) that, like the small boy in the soap advertisement, the divers are happiest when they get it. (2) They state that after their dive, when they climb into the D.S.D.C. and commence breathing oxygen they feel very refreshed. This may in part account for the feeling of fitness on the bottom, since even though breathing atmosphere air, they are even then exposed to two atmospheres of oxygen. (3) The exposure of one diver to 88 minutes' breathing of oxygen at an average pressure of two atmospheres, produced no evil effects, except subsequent sleepiness. (4) After three months' diving there was a slight diminution of lung fibrosis in all ten divers. (5) In one case functional albuminuria was prevented by the use of oxygen.

What standard of fitness has been regarded as essential for deep sea diving?—Except that the diver should be possessed of a very stable mentality our experiences do not suggest that it is necessary for the deep sea diver to be any more fit than a shallow water diver.

Volunteers for deep diving must have had over two years' experience in shallow diving, and be under the age of 30. While deep diving was in the experimental stage, to be on the safe side only the very fittest were chosen. This was partly to ensure that if the work proved very arduous, the diver would have the stamina to stand up to it, and partly to eliminate all those subject to illnesses which, if they occurred during the trials, would hang up the man's diving. From the information gained it is hoped to be able to reduce the standard of fitness now that routine training has been instituted. Previously the thin spare type was regarded in our Navy as the most suitable for diving. Our experiences suggest that the thin type has not always the same physiological and psychological reserves. Deep diving, since the pressure against which the diver has to work is greater, requires a more powerful build of man. Personally I like to see a moderate supply of adipose tissue; the work is sufficiently hard to work off any excess, and a small fatty layer protects against the cold. The entrance medical examination was mainly directed to obtain a stable heart, a sound labyrinthine system, and healthy lungs. It was required that these systems should stand up to some hard work and, if necessary, hard knocks.

The examination was similar to that of the Air Ministry, and my thanks are due to them for their assistance, and especially to Wing-Commander Tredgold.

Some of the candidates accepted had one defect, but this was only permitted if it was not considered likely to produce an adverse effect on the diver. One of the divers had a well-marked hyperpiesis but he came through the season just as well as the others, and actually was much healthier afterwards than before. His blood-pressure at the beginning of the season was 143/93, and at the end of the season 132/80.

A test that I call the 250 test, which I found useful in inducing albuminuria if any disposition to it existed, revealed an interesting condition in one diver. The test consisted of touching the toes with the fingers 250 times in ten minutes; to be satisfactory, the pulse-rate should not exceed 130 on completion, and should return to within 10 per cent. of the pre-test rate in twenty minutes. One diver was found after this test to have his urine loaded with albumin. When this test was repeated and oxygen was breathed instead of air, no albumin could be detected. This test was carried out by him thirty-seven times in six months and the result was always the same. Renal efficiency tests suggested that this was a case of functional albuminuria. Other cases of this complaint were subjected to similar tests, and in every case the amount of albumin was diminished or eliminated altogether by the use of oxygen.

Another test employed, which is not in general use, was the mental excitability test; it was a modification of a similar test invented by the Japanese. Small strips of blotting paper, treated with carbol fuchsin, and mounted on plaster were placed on the palm of the hand, and a control strip was placed on the chest near the axilla. The test relies on the assumption that sweating of the palms is due to mental excitement or pain and is not due to heat. I considered the result positive if the stain on the palm was about twice as pronounced as that made by the control strip. This test gives moderately accurate results.

Value of certain medical tests and results obtained.—These trials have afforded an opportunity for exhaustive and continuous application of certain tests; moreover they supplied what must be regarded as something approaching the optimum figures for the tests, for owing to the rigorous medical excluding examination and the healthy lives the candidates lead, it would be difficult to find a healthier body of men.

At the initial medical examination very many tests were applied, not so much to exclude candidates as to throw light on the efficiency of the test for separating the likely successful divers from the likely unsuccessful divers. Therefore, blood-pressures, pulse-response tests, 40 millimetres test, balancing and labyrinthine tests, and vital capacity tests were applied daily, before and immediately after diving. As would be expected, daily variations were always present and existed during different times of the same day, but they were slight. Towards the end of the diving week, blood-pressures were on the up-grade, and vital capacities falling, all very slightly. The long week-ends effectually restored the levels to par. Further, this tendency could be observed at the end of the three months' diving season. This was most noticeable in the diastolic blood-pressures. Incidentally, the men with a slight hyperpiesis showed the better stamina.

I attach great importance to a stable labyrinthine system, since the diver may have to work in bad lighting conditions. Contrary to the usual experience, the holder of the best records for the 40 millimetre test showed the least desire to hold out under unfavourable conditions. To hold with one's breath a column of mercury

at 40 mm. for 2 mins. 23 sec. is almost unheard of. This diver exhibited wonderful endurance in achieving this figure, but his endurance on the bottom was strictly limited; psychologically he was not so stable, and it might have been something in this direction which hampered him when diving. He had repeated attacks of caisson disease and therefore was removed from the deep diving list. Very little difference could be detected in the figures obtained before and after diving. One noticeable after-effect, probably due to oxygen, was an overwhelming desire for a nap a few hours afterwards, even after sitting in the experimental chamber in London.

Working conditions on the sea bottom at 300 *ft.*—At 300 ft. the divers have to work against a pressure of ten atmospheres, and in addition have to contend with the low temperature of the water; so it is desirable that they should have some protecting layer of fat.

By means of a toy which I have had made, I have studied the heart condition of the diver when working and when at rest on the sea bottom. It consists of a microphone fixed over the apex of the heart, connected through the divers' helmet to an amplifying set on the surface, and thence to a loud-speaker or head-phones. By means of this device I found that the diver at work on the bottom had, in spite of the pressure of ten atmospheres, an increasing pulse-rate of only five beats per minute over his pulse-rate for similar work on the surface. I attribute this to the slowing influence of oxygen, for at this depth the diver has the benefit of the equivalent of two atmospheres of oxygen—the oxygen in the air being responsible for one-fifth of the total air pressure.

I am having another device made to record the respiratory rate of the diver. It consists of an electric belt worn round the thorax, and connected through to the surface to four electric bulbs. It is so arranged that at rest bulb 1 lights on inspiration and dims on expiration; under working conditions bulbs 2 and 3 are illuminated depending on the depth of inspiration; bulb 4 means maximum expansion.

The condition of a diver on returning from work at 300 *ft.*—He is as fit as and often fitter than when he went down. Diver after diver has told me the same, and their statements are substantiated by a number of records. I quote a case at random: Blood-pressure before diving, 123/79; after, 116 and 85. 40 mm. test, before diving column maintained for 62 seconds, after dive 64 seconds. Pulse-rate per 5 seconds, 7, 6, 7, 6, 7, 6, **8**; after dive, 6, 6, 6, 6, 6, 7. Pulse-rate resting, before dive 74; after dive 72. Pulse response test: pulse on completion of test, 116; at end of one minute, 92; after diving, 108 and 82. Vital capacity before dive, 5,250; after dive, the same.

Are there any dangers peculiar to deep diving?—None that we have yet encountered. More care is necessary to prevent the diver coming to the surface too rapidly, since he is more heavily charged with nitrogen. The danger zone for oxygen poisoning is more nearly approached, but we are careful to keep outside the zone. So far no case has been encountered and we do not anticipate having to cope with this danger. Carbon dioxide poisoning requires attention, since 1 % in the helmet on the surface becomes 10 % at a depth of 300 ft. There was one mild case this year.

Slight attacks of giddiness may be experienced on the bottom. This we believe in most cases—in one we have positive proof—to be due to the diver descending too rapidly, and, by putting too great a strain on his tympanum, upsetting the labyrinthine system, reflexly.

In 1930 one diver died from complications following caisson disease, and by some it was considered that psychological forces presently to be described played a contributory part. With regard to this case I wish to make it clear that the caisson disease encountered in deep diving in no way, as far as we have encountered it, differs from the forms manifested in shallower diving or tunnel work. It cannot be too strongly stressed that the cure for caisson disease, whether caused by tunnelling, shallow, or deep diving, is the same—immediate and adequate recompression. No matter how serious the case, if recompression is properly carried out, the treatment should succeed.

Caisson disease may assume a host of forms. If the reader considers the different places in which the bubbles may form, he can evolve the symptoms which will ensue from the mechanical obstruction caused thereby. Some places are, however, more prone to caisson disease than others—for example the blood, muscle, nerves and organs may be affected. Bubbles tend to form where circulation is poor, but except where decompression is seriously inadequate, the blood and viscera escape. Even where decompression is at fault, recompression will save the case; especially is this so where the D.S.D.C. is used, for the diver is under observation and treatment is greatly facilitated. This year (1931) in deep diving we had 16 cases of "bends"—an extremely painful manifestation of caisson disease caused by a bubble in a sensory nerve or nerve ending. These cases were all cured by a recompression pressure of a few pounds. Of these, five occurred in the same diver and this necessitated precluding him from further deep diving. It seemed to me that these bends were more likely to occur on damp days. It is certain that when divers suffer from a neuritis-like after-effect, these attacks always coincided with wet weather.

Oxygen breathing was carried out during recompression, and here, as in decompression, an appreciable saving of time is effected. The recompression chamber is comfortable, and the diver has one or two attendants and can read or play cards during the lengthy process of recompression.

Some men appear to be more liable to caisson disease than others; it is one of the dangers to which all divers and tunnel workers are subjected if adequate decompression is not given, and it is not peculiar to deep sea work, nor was it caused by the new train of symptoms which I am about to describe. However it is considered by some that these symptoms played a contributory part in the case of the diver who died.

The sequence of these new events and their influence on diving were as follows: During the 1930 season, when working, or in many instances resting, at from 270 to 300 feet, the diver experienced what to him were new sensations; he found that it was much more difficult to assimilate facts and to exercise the quick decision essential for successful diving. It might be summed up as a slowing cerebration. Some of the divers went a stage further, for when they returned to the surface they stated that they had "passed out" when on the bottom. It was known that if this was so it could not have been for long, for they had answered by their telephone the instructions they were continually receiving. Others stated that they had experienced a detached feeling, as if they were under an anæsthetic. Another when asked to describe deep sea diving said:—

"You notice the dark more, though it may not be darker. The light is a comfort and

at 40 min. for 2 mins. 23 sec. is almost unheard of. This diver exhibited endurance in achieving this figure, but his endurance on the bottom v limited; psychologically he was not so stable, and it might have been this direction which hampered him when diving. He had repeated att disease and therefore was removed from the deep diving list. Very li could be detected in the figures obtained before and after diving. after-effect, probably due to oxygen, was an overwhelming desire hours afterwards, even after sitting in the experimental chamber in

Working conditions on the sea bottom at 300 *ft.*—At 300 ft. the work against a pressure of ten atmospheres, and in addition hav the low temperature of the water; so it is desirable that they protecting layer of fat.

By means of a toy which I have had made, I have studied of the diver when working and when at rest on the sea b of a microphone fixed over the apex of the heart, connect helmet to an amplifying set on the surface, and thence to a phones. By means of this device I found that the diver a had, in spite of the pressure of ten atmospheres, an increasin beats per minute over his pulse-rate for similar work on this to the slowing influence of oxygen, for at this depth of the equivalent of two atmospheres of oxygen—the oxy sponsible for one-fifth of the total air pressure.

I am having another device made to record the res It consists of an electric belt worn round the thorax, an surface to four electric bulbs. It is so arranged that at tion and dims on expiration; under working conditions depending on the depth of inspiration; bulb 4 means

The condition of a diver on returning from work at often fitter than when he went down. Diver after their statements are substantiated by a number random: Blood-pressure before diving, 123/79; a before diving column maintained for 62 seconds, per 5 seconds, 7, 6, 7, 6, 7, 6, 8; after dive, 6, before dive 74; after dive 72. Pulse response t 116; at end of one minute, 92; after diving, dive, 5,250; after dive, the same.

Are there any dangers peculiar to deep encountered. More care is necessary to prev too rapidly, since he is more heavily charged oxygen poisoning is more nearly approached, zone. So far no case has been encounter cope with this danger. Carbon dioxide p the helmet on the surface becomes 10% a case this year.

Slight attacks of giddiness may be e in most cases—in one we have positive rapidly, and, by putting too great a stra system, reflexly.

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company. You notice things more if there is nothing to do ; I get comfort from seeing the fish, it takes your mind off everything else."

This diver also had patchy loss of memory ; his main statement is more a history of mental tension, but it is valuable inasmuch as it shows that in 1930 at any rate, a tension existed in some of the divers whereas in 1931 we failed to get any evidence of its existence. Another diver said : " You get keyed up in deep water " ; he also had some difficulty in remembering the work he had done.

An old hand at diving, when asked for a description, gave the following account :—

"You have to be more careful in deep water; in deep water you know that you are concentrating." He described how " you think of each heave as you turn a spanner." Adding . . . " If you go down with a set purpose it becomes an obsession, it will become the main thing and you will forget everything else."

He described how he thought very deliberately :—

" I have finished my job, what shall I do next?—of course I have finished and now I must go up."

He described how he was aware of every action.

" If my hand goes out I think of my hand going out."

He gave the following as an analogy :—

"If I saw a thing of value, say half crown, in the street, I would pick it up. Down below I would look at it and think—' What is that, shall I pick it up?—yes, I will pick it up,' and then I would feel my hand go out."

The latter is, I think, the best description of how most of the divers felt in 1930 when between 270 to 300 feet. Some felt it less, others more. With two exceptions all the divers looked and felt fit when they returned to the surface. The exceptions were white faced and " windy " when they came out of the D.S.D.C.; these two were regarded as unsuitable for further deep diving.

These accounts given by the divers had to be sifted and action taken to discover the cause of their loss of memory. Sir Leonard Hill was of the opinion that the cause was mental and not physical. The Admiralty Deep Diving Committee asked for and obtained the assistance of the Medical Research Council in investigating these new disorders, and Professor Culpin was appointed to investigate the problem. From the descriptions given him he considered that these symptoms were more likely to be expressions of a mental than a physical disorder, and he stated that he had met with a similar condition of so-called loss of consciousness in cases of shell-shock. Professor Culpin then interviewed these divers and reported that with three exceptions they were free from symptoms. Two of the three were the men who, as a result of their experience on the bottom, had been declared unfit for further deep diving. In these two cases Professor Culpin succeeded in restoring missing pieces of memory. The third exception had only had a very slight loss of memory. The same method which had succeeded with the other two men was employed, but the endeavour to piece together his memory failed. This man was permitted to continue diving; this year he felt no abnormality and was regarded as our most successful diver.

The following is a complete report of a diver who arrived at the surface blanched and windy, and was excluded from further deep diving. He was one of the divers

whom Professor Culpin successfully treated for loss of memory. I am indebted to Professor Culpin for this summary of the account given at his interview with the diver.

The interview was directed to obtain an insight into the psychology of the diver as well as to restore, if possible, missing links of memory. The detailed account which the diver gave when in a mildly hypnoidal condition, warranted the assumption that his memory had been restored. Regarding his own psychology, the diver volunteered the following information:—

"I don't like to attract attention, nor would I care to go alone into a teashop which I did not know, for I would feel that everyone was watching me; I would rather go hungry! Discipline irks me, I am afraid of doing the wrong thing, I often have the feeling of being watched, it affects me when in charge of strange men. I keep to myself, and I am afraid, sometimes worry what others think about me."

As a child he dreaded his father. Coming nearer to the events which affected his diving, he said:—

"I never remember being afraid of the dark, but I have always been afraid of enclosed spaces; I get a feeling of being sealed in."

The terror (his own words) came on first when skylarking with others he found himself at the bottom of a scrum and was nearly suffocated. Once as a child he was thrown into the sea, and since then has not liked it, and although he has passed swimming tests he does not like going out of his depth. As a diver he was frightened of making mistakes. The old fear of being closed in came back to him:—

"It had not worried me for a while, but it came on that time just before I went off—on the bottom—that stirred it up, and I have had it ever since."

He then described his deep diving in 1930.

"I felt dizzy at 240 ft., and at 270 ft. I felt like being in a nightmare. It felt like going under ether, I think that is what made me think of going unconscious. I had a feeling of being closed in and went off. I did not tell them what I told you, I just said that I had been unconscious. On that occasion I felt tingling in my limbs, and I thought that the heavy pressure was crushing me into my suit. I thought that if I ever get out of this I'll never dive again. After this I cried off deep diving, but thought it over and afterwards asked to be allowed to carry on."

He described his last dive, which was at 300 feet, as follows:—

"I left the ladder determined to get to the bottom; at 250 ft. I got a recurrence of the tingling, and a feeling of lying on my back. I decided to rest for a couple of minutes and then go on. I slid 10 ft., and felt I was going unconscious. I made signals to be pulled up and kept repeating them, I lost the use of my limbs and let go everything. While hanging on the shot rope, I saw my own face in the front glass, it was outside the glass and looked all greenish. I was dressed in my shore-going suit! I heard the order, 'Pull the diver up,' again and again, as if someone in the suit were saying it. When I got to the submerged chamber I did not appreciate the oxygen as usual, I wanted fresh air."

At the interview with Professor Culpin he was placed on a couch, with closed eyes, and directed to go over the descent "as if it were happening now." With some urging he repeated the performance, and seemed to recall the whole of the period for which he had claimed to be unconscious. At one stage he cried:—

"Pull me up, for God's sake pull me up. I feel as if I'll never get up. I'm tied to the bottom, my mouthpiece is caught under my nose. It is getting lighter now, I can see the chamber."

Then he was made to sit up and tell the story again. This time he gazed straight ahead and talked as if he was still going through his experience, and he was able to add a few details to his first account :—

"I felt that I was being pulled up against resistance, as if a fellow was trying to hold me down, I am fed up and want to get out—worried because I can't open my by-pass; I seem to take two minutes trying to open it.'

In the talk which followed he agreed that incidents he had forgotten had now come back to him. It was decided that neither this diver nor the other who had also been under observation, was sufficiently stable mentally for further deep diving.

Candidates found to have a similar psychology are to be debarred, at least for the present, from deep diving. To prevent this type being selected, an interview, designed to look for these symptoms, was included in the medical examination for deep sea divers at H.M.S. "Excellent," and those passed by me were further vetted by Professor Culpin.

The ten divers for the 1931 season were examined and passed as free from symptoms, although the tenth was only passed after consultation between Professor Culpin and myself. The first nine divers encountered nothing abnormal, and no loss of memory or other unusual sensation was noticed during this diving season. Most of them, however, when in the experimental chamber at Siebe, Gorman's, at an air pressure equivalent to a depth of 300 ft., did experience a momentary giddiness. If they were reading, the print became blurred for an instant. This sensation was not repeated when working at 300 ft. After seven weeks' diving the tenth diver developed acute claustrophobia when at a depth of 270 ft. He is of the suppressed nervous type, who habitually exercises self-control. This attribute he has developed to a remarkable degree. The other divers told me that he was inclined to be erratic, and that he much disliked being the first to go down to an increased depth, or to be the first diver of the day. On the day when he broke down he unfortunately was the first diver of the day. He was only partially conscious of his own nervousness; for instance, he does not like going into the officers' mess ; if he is in uniform ashore he feels he is being watched; more important—he was frightened of the dark as a child, and even now is very frightened of horses, nothing could induce him to pat a horse. In reply to the questions as to certain of his mental speculations, he admitted, "I often think of where I come from, but I must not *talk* of it or they would think I am qualifying for an asylum." A history such as this seems to point to mental instability, but apart from these peculiarities—and they are, or certain of them are possessed by many of us—he appeared to have a very equable temperament, and the deciding factor in accepting him was his splendid physique.

During the chamber tests he gave a strong positive reaction to the Mental Excitability Test, but he insisted that he had not felt anything unusual. After the present breakdown he confessed that he had felt queer on one occasion. When asked if the feeling had been similar to that immediately preceding his breakdown, he said :—

"You cannot possibly compare the two conditions: in London, in the chamber, it was light, and there were others with me ; on the bottom it is dark and lonely."

While he was diving I kept him under as close observation as I could without

rousing suspicion. On one occasion his pulse-rate on the bottom was much too fast for the work he was doing, and I suspected from his conversation on the telephone, which sounded very artificial, that he was not altogether happy. I considered removing him from the trials, but this was a drastic procedure, especially as my suspicions were based on such flimsy evidence. On his last dive he had been six minutes at the bottom at 270 ft. when he urgently demanded to be brought up, he gave no reason but constantly repeated his demand. He did not appear to be in a panic but was most imperative in his request. Right up to this point he had been conversing on the telephone, and giving instructions to the surface regarding the hoisting or lowering of wires connected with his work. We had great difficulty in making him remain at his decompression stops, his one desire was to get up and get to the submerged chamber, if not to the upper deck. The chamber was specially lowered to a greater depth than usual, to comply with his request. The chamber attendant reported that, on arrival in the chamber he looked normal, but very white, and his eyes looked glassy. During decompression he became more cheerful and tried to describe what had happened on the bottom. He said,

"Have you ever felt you would like to murder a 'so-and-so'? Well that is what I felt like on the bottom when I came to, and found myself trying to unscrew my front glass; my one idea was to get out of the helmet and into the chamber."

When he emerged from the D.S.D.C. he seemed like one who has sustained a severe mental shock; his ocular appearance and whitened face supported this impression. Physically he was badly shaken, but no more. He was overcome by the situation, and deeply self-conscious of failure; indeed the main difficulty in restoring him was to overcome this idea. He was striving desperately to recover his self-control. He could not bring himself to recount his experiences verbally, but agreed to write them down.

The following extracts are from his own written statement.

"I was at the time kneeling on my right knee and head down (the required position for putting clips on the door) when suddenly I came over rather funny. It was a distinctly different feeling. I stood up, the tank wire in my right hand, and thinking it was a touch of CO_2, I began to breathe deep and hearty, thinking of course that in a couple of minutes I would be able to resume work. Then I seemed to go quite limp, a feeling of no life or energy. This was new to me, whether it was a part of CO_2, I didn't know, because I have never experienced a real dose of CO_2; anyhow, after stopping and doing the drill for CO_2, I thought I would be alright, but suddenly something seemed to—say—snap inside my head, and I started to, what I thought, go mad at things.

"I had small laps of this, on and off. Breathing became difficult, possibly I might have asked for more air, I couldn't say for certain. I really did try, and fought hard to beat off this madness, but it all seemed of no avail. I didn't get worse, but such as it was, it was quite enough for me. I wasn't in a real panic, and ready to do anything that came to hand, although I did make a hash in some things. Anyhow my one ambition at that moment was to get my helmet off, the quicker the better. I fought hard to stave off this feeling, but it wouldn't go. I should say that unless one had experience of this kind of thing it would be very difficult to imagine and realize such. I felt slightly relieved when, after closing my ejector, I left the bottom. After going say—30-40 ft. up, I came to the conclusion that I was coming up a wire. I stopped, and I was pretty well O.K. I thought to myself, why I should think so I suppose was for the simple reason that the shot rope is the shot rope and every diver knows what it is and that I was going all wrong.

"Naturally in that moment of, say recollection, I decided, although much against my inner feelings, to go down the wire, and leave the bottom a bit like a diver is expected to. Down the wire I went, and arrived on top of the tank, slid off, and stood up. I don't remember how I actually left the wire, and got to the shot rope, anyway, I must have found the shot rope because I came up it. At this time, i.e., when I was standing at the foot of the shot rope ready to ascend, I was perfectly normal, I felt my ejector, was it already closed? Or did I close it then? I can't remember, at any rate I did ensure it was closed before I left the bottom.

"I left the bottom, and as regards my ascent, can remember travelling light, or I should say light at one period. Of course, as regards the phone, which the Petty Officer attends to, I was simply saying things that I wanted to, and was not interested in the answers, I say not interested, but to take everything into consideration, I didn't look or wait for any answers, one must say that I was pure and simply giving orders. I had a check at — ft. I don't know, but at the time I dimly remember 110 ft., of course that being the check that coincided with the decompression tables. Since then I have been told it was 90 ft.

"I felt something happen on the shot rope, and I guessed it was the chamber being lowered to a depth that would be of some help to me, which afterwards proved to be correct. I received the check signal at—90 ft., and although I answered it, I really, inwardly, didn't want to. Once again my sane ambition was to get either on deck, or in the chamber, and have the helmet and glass taken off. Of course now at the present moment I am alright and as one might guess, I feel a wee bit self-conscious of myself, but still at the time, I felt that I never wanted to be dressed as a diver again. Between now and then my views might change, but that remains a future answer.

"After doing a check which was very short, presumably a minute, again I had the greatest of all fights to stop there and do it. I had the phone message to go to the chamber. Just above me was the chamber, and I gladly got on to the ladder, and although in such a 'paddy' and 'panic' with myself, I did try and do things as I always had done. I undone the front weight lanyard, and let the attendant take the weight off, then I got secure in the chamber and got my front glass off. After stepping on the ladder and letting him take my front glass off, I didn't feel as happy as I thought I would, because things seemed in the same condition somewhat. It was a relief, however, to have the front glass off, and the helmet soon followed. While on the bottom I thought it would be absolutely good to have the helmet off, but, when it was off I didn't feel as I have before. I told the attendant everything was O.K., because physically I was alright, and again, my sense of self-consciousness came into play. But taking it all round, I just didn't have and couldn't display the usual amount of life that I have done on previous occasions. From then onwards I felt pretty well alright."

When he arrived on the upper deck he was on the verge of, at least, a complete mental breakdown. To keep his mind temporarily off the subject, he was sent on shore with two of his fellow divers and plied to the brim with alcohol. The danger in his case was that he would attempt to suppress the incident and relegate it to his subconscious mind. To avoid this I persuaded him that night verbally to recount his experiences on the bottom. Practically no hypnoidal effort was required to produce the horror of that morning's dive, and the picture of stark mad terror which even the interview could produce, left an impression which is very difficult for me to describe to you. My impression was of sitting in the stalls and watching the acting of a Grand Guignol. To such a pitch did he arouse his emotions, that he clawed at his face to remove the imaginary face glass and tore his clothes which he mistook for his diving suit.

The production of an abreaction produces as satisfactory a result as the surgeon's knife in abscess formation, and it was so in this case; from this on, the dam was loosened, and he was enabled to talk to the others of his experiences; previously he had refused to talk on the subject.

Since the incident two shallow water divers were reported as "windy." In each case I found the cause to be claustrophobia. In one, who was very particular about his air supply, I found that as a boy he had nearly been suffocated in a pillow fight, and ever since had been terrified about not getting enough air.

To sum up: The four failures in deep diving, and two in shallow diving, have many points in common. These men were of the suppressed nervous types, who habitually exercise control. Shy, reticent and self-contained, they work best by themselves and do not relish observation. They are usually of a philosophic, rather than a practical, disposition.

The most desirable method of selection to avoid mental instability is a matter of opinion, but my experience suggests that for the present such a state of mental instability, slight as it is, debars from deep diving. Some advocate a very complete psycho-analysis, others preferring to rely on a very complete history of the diver from his first dive, coupled with a very close observation by instructors and officers, such observation being minutely recorded. The latter method depends on skilled and accurate observations which must be carefully recorded, but when the observer and observations are known, this is the method *par excellence.* At the time of these experiments this method of collecting facts had not yet been instituted, hence resort was made to the former method, which depends on an accurate forecast, by an expert, after careful study as to how the candidate is likely to react in given circumstances, mainly of the darkness and loneliness which may be encountered on the bottom of the sea, both of which are now largely mitigated by powerful arc lamps, an efficient telephone and observation chambers.

I do not wish you to think that the problem presented by these factors is to be regarded as comparable to the prominence which I have given to it in this paper. I have spent extra time on the subject because it is new. It is not peculiar to deep sea work, for we have found it in shallow water divers. It is something already in the constitution, which comes to the surface; fear of the unknown would be just as likely to produce the same symptoms in the persons I have mentioned.

I would like to acknowledge my indebtedness to Sir Leonard Hill, Professor Culpin, and Mr. R. H. Davis, Managing Director of Siebe, Gorman & Co., Ltd., for their assistance in the preparation of this paper.

Editorial.

RECENT WORK ON VITAMINS.

During the past two years considerable advance has been made in our knowledge of the chemical constitution and physiological action of vitamins.

In the July number of this Journal for 1930 we referred to the work which had been done on the anti-infective action of carotene. A good deal of evidence has now been accumulated which shows that carotene may eventually be converted into vitamin A in the body, particularly in the liver. The administration of carotene to animals fed on a diet deficient in vitamin A is followed by a return to normal health and the appearance in the liver of a substance showing the properties of vitamin A. Akmad, when investigating the quantity of carotene that must be given to animals to restore their normal rate of growth, found considerable variations which appeared to be associated with imperfect absorption of the pigment from the gut. Experiments showed that the absence of fat in the basal diet was the cause of the poor absorption of the pigment, most of which was found in the fæces and proved to be unchanged carotene.

In the Editorial last month we referred to the standard preparation of carotene, specially purified by Dr. Dudley and Dr. Rosenheim and sealed in ampoules completely freed from oxygen, which has been accepted by the International Conference of the League of Nations as an international standard of vitamin A activity. It is unlikely that the adoption of this standard will necessitate any considerable revision of the previously accepted vitamin A values of common foods, though foods previously classed as rich in vitamin A may contain none of it preformed, and owe their activity to their carotene content.

The stability of vitamin A during cooking processes has been stressed by Scheunert and Wagner. They have found that the common methods of household cooking could be applied to butter fat without producing any loss of the vitamin A contained in it. Even prolonged cooking scarcely affected the vitamin A content of green or yellow vegetables.

The experiments of Green, Pindar, Davis and Mellanby suggest that during pregnancy extra quantities of vitamin A over and above the amount in the ordinary dietary may confer an increased resistance to bacterial infection.

Liberal supplies of vitamin A given in early life to animals seem to prevent the development of pyorrhœa alveolaris. An ample supply in later life affords some protection, but this is never so great or so complete as that afforded by liberal supplies in early life.

The relation of vitamin A deficiency to night blindness has recently

received further attention in England. Seventeen cases in one year were reported in one ophthalmological department in Newcastle. They were mostly in children and rapidly recovered when given either cod-liver oil or milk and butter.

Wright has found that keratomalacia is responsible for more blindness in the children in Southern India than ophthalmia neonatorum, syphilis or trachoma. Vitamin A deficiency seemed to be the chief factor and the children rapidly recovered when given cod-liver oil. He also found diseases of the liver were often associated with keratomalacia, both in children and adults, and it seems probable that derangement of the liver prevents the conversion of carotene into vitamin A.

Field has reported keratomalacia and night blindness in the Malay States. The disease was more common among the immigrant Indians than among the Malays and Chinese, and the explanation seemed to lie in the difference in their diets. The Malays grow a good deal of fresh green food on their holdings, and this supplies them with sufficient vitamin A.

The relation of vitamin A deficiency to the formation of urinary calculi has been studied by McCarrison. The formation of stones is encouraged by a deficiency of vitamin A and phosphate in the diet and also by excess of calcium and some unknown toxic substance found in certain cereals. Stones were never found when there was a perfect calcium-phosphorus ratio, even when the diet was deficient in vitamin A.

Topley, Greenwood and Wilson, studying the effect of diet in epidemic infections in mice, came to the conclusion that their experiments had no immediate bearing on the probable effect of increasing the consumption of vitamin A among a human population submitted to the ordinary risks of communal life. They doubt whether the consumption of relatively enormous amounts of vitamin A is likely to be a successful measure in combating bacterial infection. They have some confidence in concluding that it is unlikely that any modification in diet will so increase the average host resistance as to afford efficient protection against the major risks of epidemic infection.

Brums, Oberhoff and Wolff have endeavoured to determine the molecular weight of vitamin A. Recent work having shown that carotene is probably the vegetable source from which vitamin A is built up, and should be considered as a "provitamin," Brums, Oberhoff and Wolff thought the relative molecular size of the two substances might be determined by their diffusion constants in the same medium. If the constants were of the same order of magnitude, then the conclusion could be drawn that a simple chemical relation (e.g., a hydrogenation or an oxidation) existed. The diffusion constants, however, were found to be so different that a simple chemical relation cannot exist between them, and there must be a more radical transformation of the molecule. The ratio of the molecular weight of the two substances was calculated, and from this a molecular weight of about 330 was deduced for vitamin A.

The outstanding advance as regards vitamin D has been its preparation in crystalline form as calciferol. It was questionable for a time whether it was possible to obtain preparations of irradiated ergosterol which retained their anti-rachitic properties and were non-toxic.

The production of toxic symptoms by over-doses of irradiated ergosterol was first recorded by Pfannenstiel in 1927, and by Kreitmair and Moll in 1928. Other observers were unable to confirm this result, and discredit was thrown on the theory of hypervitaminosis ; the ill-effects noticed were attributed to toxic by-products formed, it was thought, by the irradiation of the solvent. Harris and Moore, however, showed that the severity of the ill-effects ran parallel with the amount of ergosterol ingested, that specimens of ergosterol in various solvents or no solvent were equally toxic, and that the destruction of vitamin D by over-irradiation entailed a corresponding loss of toxicity. These conclusions were confirmed by other workers in 1929.

Harris and Innes (1931), in their research on vitamin D action have shown that an increased vitamin D intake promotes absorption of Ca and/or phosphate from the gut (or decreased excretion into the gut), so tending to raise the level in the blood. With large overdoses of vitamin D, hypercalcæmia and/or hyperphosphatæmia cannot be prevented, and to this condition the kidney responds by an abnormal urinary excretion of Ca and/or P. As more and more vitamin D is given the excretion by the kidney overtakes the absorption from the gut, so that the resulting retention which is increased by moderate doses is diminished by very large doses. The deposition of calcium salts in certain places is associated with a withdrawal from others. In hypervitaminosis this transference from bone is apt to be excessive. When the diet is deficient in calcium the withdrawal from the bone stores becomes the noteworthy feature of hypervitaminosis. When, on the other hand, the diet is rich in calcium the bone is less called upon, and there is an increased liability to calcareous deposition owing to the increased absorption from the gut. Each addition of calcium to the diet intensifies the hypercalcæmia with a given overdose of vitamin D.

More information is required before a full explanation can be given of the preferential deposition of calcium salts in certain tissues. Robison has shown that the presence of phosphatase is of importance, so too, perhaps alkalinity.

It seems probable that vitamin D can function independently of the parathyroid, as the parathyroid hormone raises the calcium in the blood solely by withdrawing it from the bones and without increasing the net absorption from the gut.

As a result of some later work published this year, Taylor and Wild combat some of Harris's and Innes's views. They agree that irradiated ergosterol, when given in large doses, will cause marked hypercalcæmia, but dispute the source of the excess serum calcium. They conclude that the hypercalcæmia is due to withdrawal of calcium from the skeleton.

Ergosterol in amounts which produce hypercalcæmia does not increase absorption of calcium from the intestine. It depresses the power of the intestine to excrete calcium, and the calcium mobilized from the skeleton accumulates in the serum.

It is now generally agreed that infants and young children in temperate climates, especially those living in towns, require a greater supply of vitamin D than is given in their ordinary diet. It has been suggested that they might: (1) receive a regular supply of cod-liver oil or irradiated ergosterol, (2) be exposed to artificial sunlight, or (3) have the vitamin D content of a constituent of their diet, milk, raised by irradiation or by feeding cows with irradiated yeast. Cod-liver oil is considered to be superior to irradiated ergosterol as it is not liable to produce toxic effects, and it also provides a valuable supply of vitamin A.

Mrs. Mellanby has shown that vitamin D is a valuable preventive against caries of the teeth in children, and this work is supported by large-scale investigations carried out for the Medical Research Council. Other workers stress the importance of a liberal supply of calcium and phosphorus as well as vitamin D.

The vitamin B complex seems to be becoming more and more obscure. Many workers agree that there are at least four factors in the complex. At present it is only possible to differentiate between B_1 and B_2 in relation to human health and disease.

Roscoe has determined the vitamin B_1 and B_2 content of some of the common and leafy root vegetables. Watercress, lettuce, spinach and cabbage were all found to be moderately good sources of vitamin B_1, and there was no difference found between the green outer leaves and the pale inner ones. In cooking spinach it was found that about half of the vitamin B_1 was lost in the juice which is usually discarded in this country before the spinach is served for the table.

Plimmer, Raymond and Lowndes have determined the comparative vitamin B_1 values of cereals. Their experiments do not differentiate between the several factors of the vitamin B complex; they give essentially the antineuritic value. They say that if B_3 is necessary for the maintenance of weight, its amount in cereals and pulses must be in close correspondence with the amount of vitamin B_1. They give the comparative B values as follows: Dried yeast 100, "marmite" 67, wheat germ ("bemax") 62, middlings 40, baker's yeast 33, bran 20, buckwheat 20, millet 13, oatmeal 11; wheat, barley, malt, rye, dari and brown rice each have a value of 10.

They have also tested thirty common fruits and vegetables for their B_1 content, and found that as regards the general human dietary fruits and vegetables have no important value as a source of vitamin B_1. In order to supply sufficient vitamin B_1, from 60 to 80 per cent of the diet must be composed of these foodstuffs in the fresh state, amounts which it is impossible for man to consume. Compared with dried yeast at a value of

100, dried orange peel has a value of 20, but when wet only 6; dried plums have values 13 and 6; artichokes, swedes, parsnips, potatoes and turnips have wet values varying from 4 to 7, and when dry from 7 to 12. Vegetable leaves have very similar values.

Aykroyd and Roscoe have investigated the distribution of vitamin B_2. Wheat and maize are poor sources; the germ and bran of wheat contain more than the endosperm, but maize germ contains less than wheat germ. Dried peas contain little. Dried yeast, or liver and milk are excellent sources, and egg-yolk and meat are good.

There is little fresh evidence of any widespread deficiency of this vitamin in Western countries. In the Philippines beri-beri is said to be common in breast-fed infants, though the mothers show no signs of the disease. Satisfactory cures are obtained by giving the patients the extract of rice polishings known as tiki-tiki.

It is still disputed in some quarters whether beri-beri results solely and entirely from deficiency of vitamin B_1, but there is no doubt that this deficiency plays an extremely important part in the production of the disease.

The thermostable fraction of the vitamin B complex known as vitamin B_2 is supposed to play a fundamental part in protecting human beings against pellagra. But Aykroyd has found that rice does not contain any more of B_2 than maize. He therefore found it difficult to understand why pellagra should be common in maize-eating populations and rare amongst the rice-eaters, if deficiency of vitamin B_2 was the chief ætiological factor. Mellanby has shown that the nervous symptoms in pellagra can be produced by deficiency of vitamin A combined with the toxic action of some substance present in white maize. The nervous symptoms are not produced by yellow maize, as this contains vitamin A.

Wilson maintains that a shortage of protein of good biological value plays the most important part in the development of pellagra, though he admits that many of the common sources of protein contain a moderately large amount of vitamin B_2.

As a result of his researches on nitrogen metabolism in vitamin B_2 deficiency, Kon concludes that while vitamin B_2 is undoubtedly in some way linked with the metabolic processes of the body, it is not at all evident whether this connection is to any extent of a different type from that of the general dependence of normal metabolic exchange upon the availability of any one of the indispensable food ingredients.

It has recently been announced that vitamin C has been isolated in a pure state and that its chemical constitution has been determined. Rygh and Rygh claim to have isolated vitamin C from oranges. They state that narcotine is present in unripe oranges, and on ripening of the fruit the narcotine is converted into methylnornarcotine, which they consider to be vitamin C. They also claim that they have synthesized

methylnornarcotine and have found it to be antiscorbutically active. These claims have not yet been confirmed by English workers, who are repeating the experiments of Rygh and Rygh.

In a short editorial in the October number of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, 1930, we drew attention to the work of Dr. S. Zilva and his co-workers on the vitamin C content of apples. These investigations have been continued, and in 1931 it was found that Newton Wonder apples have about the same vitamin C content as Cox's Orange Pippin, whilst Lane's Prince Albert occupies an intermediate position between the latter and Bramley's Seedling, which is much more potent.

The concentration of vitamin C in the tissues of the apple increases as the skin is approached from the core, and is more than six times as great in the peel as in the flesh near the core.

The photochemistry of vitamins A, B, C and D has been studied by Dr. Bowden and Dr. Snow at the Laboratory of Physical Chemistry, Cambridge. In a letter to the Editor of *Nature*, published on May 14, 1932, Bowden and Snow state that their experiments were carried out with the help of a large quartz monochromator. The solutions to be irradiated were enclosed between quartz windows in a rectangular slot cut in a small brass block, and arrangements were made so that the solutions could be handled in the absence of oxygen.

The procedure was to study the absorption spectrum of the substance and then irradiate it with an intense beam of light of similar wave-length to that of an absorption band selected after consideration of the spectroscopic data. Bowden and Snow found that when applied to a suitable pre-vitamin, monochromatic irradiation with light of the correct wave-length produces maximum yields of the vitamin. On the other hand, when the destruction by irradiation of the biological activity of a vitamin is effected by the elimination of an absorption band, the activity can be linked up conclusively with the presence of the band.

The wave-lengths which destroy a vitamin are not the same as the wave-lengths which create it from its pre-vitamin.

As regards vitamin A, Bowden and Snow have shown that when a solution of β-carotene is irradiated with a particular wave-length (the mercury line 2,650), after a few hours a strong band appeared at a wave-length corresponding closely with that of the band at 3,280, which is considered to be characteristic of vitamin A. Further, the solution then gave the blue coloration with antimony trichloride in chloroform, which is thought to be diagnostic of vitamin A.

Biological experiments have been begun to determine the activity of the irradiated solution, and if these are successful the problem of converting carotene into vitamin A by a photochemical process would appear to have been solved.

When, however, vitamin A is irradiated with light of wave-length 3,130, the characteristic band at 3,280 is eliminated in a few hours and the vitamin

is destroyed. The object then should be to use only rays which are absorbed by the pre-vitamin and exclude those which are absorbed by the vitamin.

A specimen of vitamin B_1 showed three absorption bands at 2,600, 2,400, and 2,100. Irradiation by the mercury line 2,537 greatly reduced the intensity of the band 2,600 and destroyed the B_1 activity as tested by Mr. Birch in the nutrition laboratory. A specimen of vitamin B_1 which had been deactivated by heating with alkali showed a similar absorption spectrum in which the band of longest wave-length was again missing. The correlation of the 2,600 band with the activity of vitamin B_1 seems to be fully established.

Bowden and Snow have not yet been able to examine the absorption spectrum of vitamin C. They have examined narcotine which, according to Rygh and Rygh, is converted into vitamin C, and have found that irradiation with light of wave-length 2,400 changed the spectrum to a single band at 2,900 A. A comparison of the spectrum of a concentrate of vitamin C with that of narcotine should help to settle the problem of the identity of the vitamin with this substance.

As regards vitamin D, the study of the conversion of ergosterol into calciferol was rendered difficult owing to the overlapping of their absorption bands, since the five narrow bands of ergosterol are almost covered by a wide calciferol band of shorter wave-length. The 2,967 line, which corresponds with the longest wave-length of the ergosterol bands, produced a strong absorption band in the calciferol region after only two hours' irradiation. On the other hand, calciferol was completely destroyed by irradiation for one hour with the mercury lines at 2,650 or 2,537. A maximum yield of calciferol is therefore to be expected when light of wave-lengths less than about 2,800 is cut out.

The study of vitamins by photochemical methods is still in its infancy, but it is already clear that it may be of great service in displacing experiments on animals and, further, that a deficiency in a given vitamin may be made good more easily by a selective irradiation than by any other method.

Clinical and other Notes.

CHARTS FOR RAPID REFERENCE IN DEALING WITH CASES OF POISONING (THEIR SYMPTOMS, TREATMENT AND POISON ANTIDOTES).

By Major D. H. MURRAY,

Royal Army Medical Corps.

Following instructions by the A.D.M.S., Northern Ireland District, to prepare a list of poisons and their antidotes and treatment, and an antidote box for use in the hospital and reception station in this area, the charts to be described below were evolved to provide a rapid and simple method of finding the information required to deal with cases of poisoning.

They are in the form of wheels. The idea was suggested by Staff Serjeant J. Ford, R.A.M.C., based on the system of the "At a Glance" wheels advertised for various purposes by a well-known newspaper. Staff Serjeant J. Ford, R.A.M.C., Serjeant A. Brooker, R.A.M.C., and the writer worked out the details of these wheels as illustrated in this article.

It is suggested that either of these wheels obviates the necessity of turning over numerous leaves, or the possibility of confusion and error in the hurry of an emergency. In addition, the charts can be hung up beside the antidote box, which contains, ready for use (in bottles or boxes), requisite doses of the commoner antidotes likely to be required.

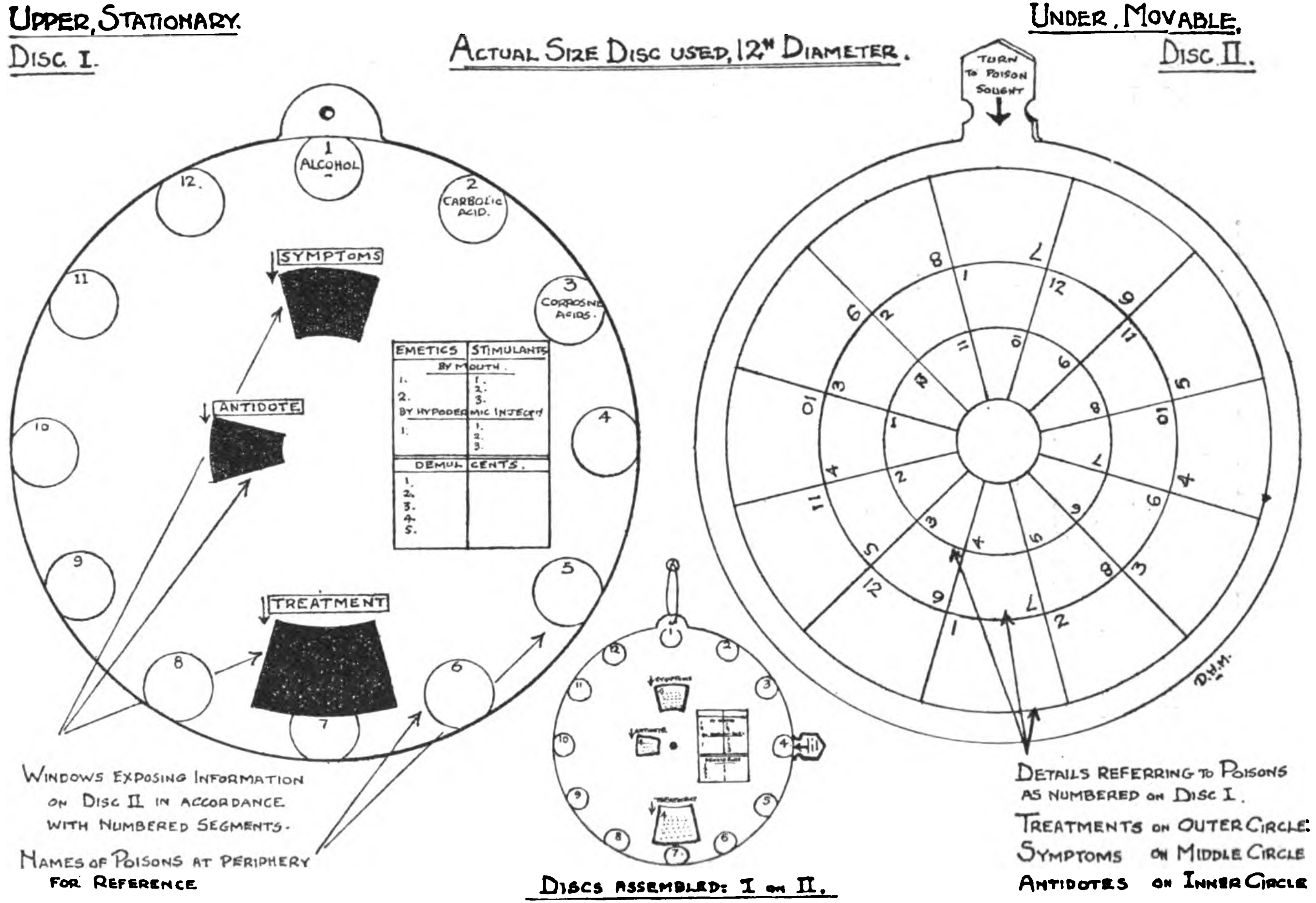
The charts illustrated are of two types, I and II.

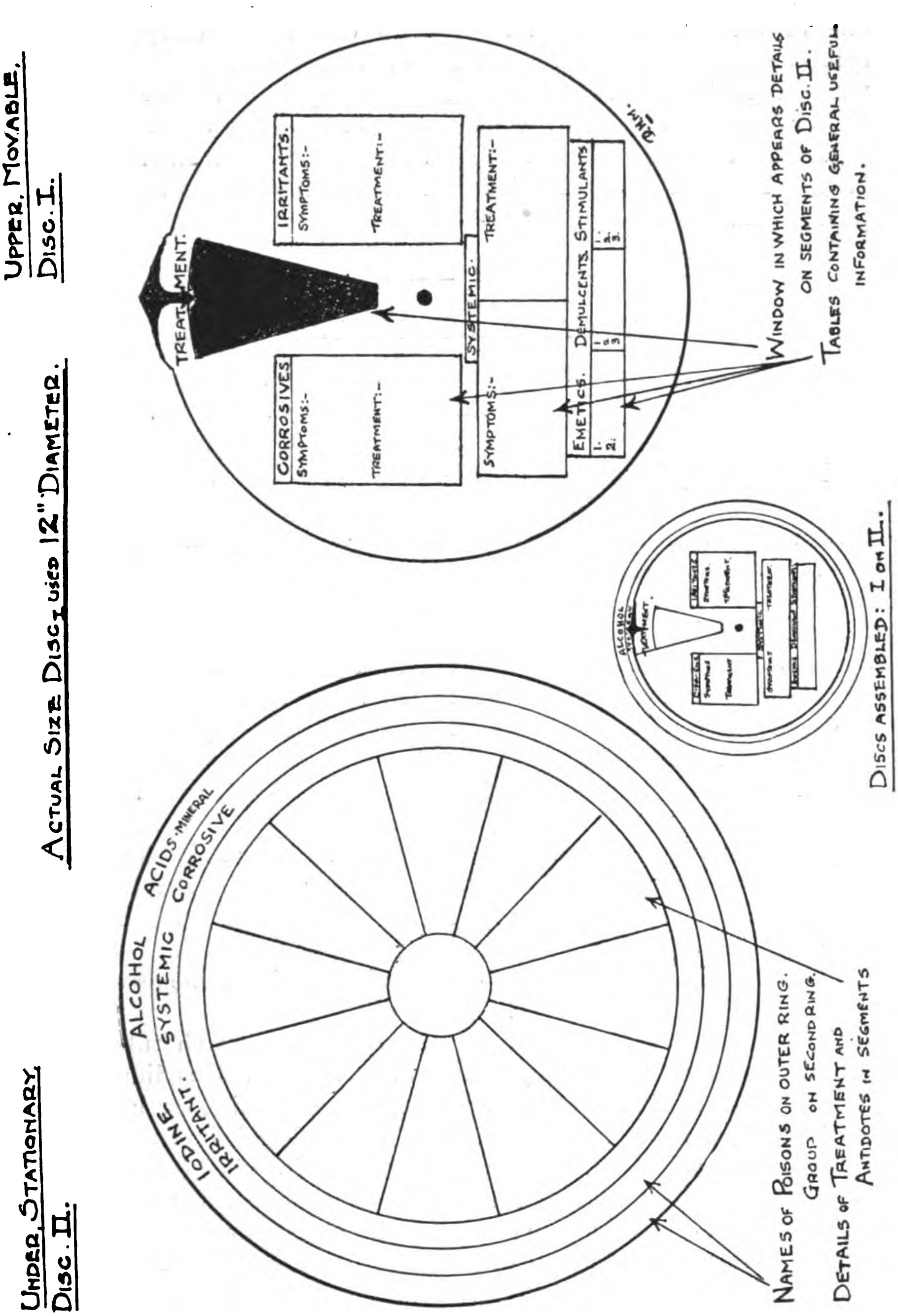
The details of these charts are given on the diagrams, numbered Type I and Type II. One "disc" is superimposed on a second, and as the second is rotated a "window" or "windows" leave exposed all the information probably needed. As can be seen, the upper disc contains the "window" or "windows," through which the details sought are shown when the indicator stops opposite the poison under consideration. The upper disc may also carry on its face in various tables notes on general useful information, such as the commoner emetics, stimulants and demulcents for the immediate information of the possibly harassed orderly or medical attendant.

At the periphery of the larger disc (the upper in Type I, the lower in Type II) are printed (and numbered) the names of the poisons under consideration. In the diagrams, twelve spaces have been used; a smaller or a larger number can, of course, be dealt with, as desired. The actual size of the disc may be made of a larger diameter than twelve inches if considered necessary, e.g., fifteen inches diameter.

In order to give greater window space it has been suggested that there should be two fixed discs, one on each side of a movable disc.

TYPE I.


UPPER, STATIONARY.
DISC I.
ACTUAL SIZE DISC USED, 12" DIAMETER.
UNDER, MOVABLE.
DISC II.
TURN TO POISON SOUGHT
1 ALCOHOL
2 CARBOLIC ACID.
3 CORROSIVE ACIDS.
SYMPTOMS
ANTIDOTE
TREATMENT
EMETICS
STIMULANTS
BY MOUTH.
BY HYPODERMIC INJECTN
DEMULCENTS.
DISCS ASSEMBLED: I on II.
D.H.M.
WINDOWS EXPOSING INFORMATION ON DISC II IN ACCORDANCE WITH NUMBERED SEGMENTS.
NAMES OF POISONS AT PERIPHERY FOR REFERENCE
DETAILS REFERRING TO POISONS AS NUMBERED ON DISC I.
TREATMENTS ON OUTER CIRCLE:
SYMPTOMS ON MIDDLE CIRCLE
ANTIDOTES ON INNER CIRCLE


Type II.
Actual Size Disc, used 12" Diameter.
Upper, Movable, Disc. I.
Under, Stationary, Disc. II.
Iodine
Alcohol
Acids·Mineral
Irritant.
Systemic
Corrosive
Names of Poisons on outer ring.
Group on second ring.
Details of Treatment and Antidotes in segments
Treatment.
Corrosives
Symptoms:-
Treatment:-
Irritants.
Symptoms:-
Treatment:-
Systemic.
Symptoms:-
Treatment:-
Emetics.
1.
2.
Demulcents.
1
2
3
Stimulants
1.
2.
3.
Window in which appears details on segments of Disc. II.
Tables containing general useful information.
Discs assembled: I on II.

The two "outer" discs would have the same lay-out, that is, with the one or three "windows"; the central disc would carry details of the symptoms, antidote (i.e., chemical or therapeutic antidote) and other "treatment" on both sides. The number of poisons dealt with would then be, for example, 6 or 8 on each outer disc, this giving a total of 12 or 16.

I have to thank Colonel W. W. Browne. O.B.E., A.D.M.S., Northern Ireland District, for permission to forward these notes and diagrams for publication.

A CASE OF ECLAMPSIA.

By Captain C. E. ECCLES,
Royal Army Medical Corps.

Mrs. H., a primipara of full term, aged 22, had been attending the Ante-natal Clinic at the Military Families Hospital, Woolwich, for a period of three months. During the whole of her pregnancy she kept remarkably well. She never complained of headache, œdema, or of any visual disturbances. Her urine was perfectly clear each time it was examined. The child lay in the left occipito-anterior position and the fœtal heart was audible. She was last examined on January 20, 1932.

At 12.30 a.m. on January 25 Mrs. H. was admitted to hospital. Her husband stated that at 10.30 p.m. his wife got a bad pain in her stomach and vomited. He thought she was in labour and brought her to hospital. He further stated that during the early part of the evening his wife was in quite a normal state of health. On her arrival at the hospital she had a very bad fit which lasted about two minutes. After this she became very cyanosed and her pulse was weak. A catheter was passed and a specimen of urine was obtained ; this was examined and was found to be loaded with albumin. The blood-pressure showed a systolic reading of 135 and a diastolic reading of 90. On examination *per vaginam* the os externum just admitted the tip of the finger.

The patient was then given an anæsthetic, a stomach tube was passed and the stomach was washed out with a solution of sodium bicarbonate until the return flow was clear a large dose of mist. sennæ co. was then left in the stomach. At the same time, a hypodermic injection of morphine tartrate ¼ gr. was given. The rectum was then washed out with a solution of sodium bicarbonate, and this treatment was repeated four-hourly, the return flow in each case being very fæcal. One hour after the injection of morphine tartrate, chloral hydrate 30 gr. was given per rectum. During the eight hours following admission, the patient was having fits about every hour. Three hours after she had her injection of morphine, she was given another injection of morphine tartrate ¼ gr., followed in one hour's time by chloral hydrate 20 gr. per rectum.

During the afternoon of January 25 she became worse, the fits were occurring more frequently and were very severe while they lasted. She was given 10 c.c. of a 10 per cent solution of calcium gluconate intravenously, followed by 500 c.c. of a 10 per cent glucose solution, in the hope that the fits would become less frequent. The result of this treatment was very efficacious, as immediately after it the fits ceased altogether and the patient's general condition greatly improved. Shortly after this, the patient went into labour and was delivered by forceps. The child, a boy, was alive, but he was very cyanosed and had a fit shortly after birth. He has only had the one fit and is now doing well.

A blood-sugar estimation made before the calcium gluconate injection showed the presence of 118 mg. of sugar per 100 c.c.; another estimation was made about twenty-four hours later and showed the presence of 68 mg. per 100 c.c. The urine was put up in an Esbach's albuminometer and gave a reading of 6 gr. of dried albumin per litre of urine.

On January 26 the patient was still unconscious and her face and ankles were very swollen. The rectal washouts were still being continued and the return was still fæcal. The urine contained a considerable amount of albumin, but not so much as on previous occasions.

On January 28 the patient regained consciousness and took some fluid by mouth. She resented being touched and was very irritable. She had a very stupefied look and kept on singing to herself. It was with the utmost difficulty that she was kept in bed, but nothing would induce her to lie down, and she kept on asking for her clothes. When she was told she could not have them she tore all the clothes off her bed. By January 29 the œdema of the face, arms and legs had subsided and patient appeared quite normal, except for the stupefied countenance which she still had.

The disturbed mental condition of the patient was apparently a mild degree of puerperal mania, and on January 29 she was transferred to a civil hospital where she remained until February 26, when she was discharged, having completely recovered.

Echoes of the Past.

THE ARMY MEDICAL SERVICES, 1870-1874.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps (R.P.).

When Sir William Muir succeeded Sir Thomas Logan as Director-General in 1874 the Cardwell Reforms were already well advanced. In 1869 the Transport and Supply Services had been consolidated under the Board of Control, the Commissariat Transport Corps came into being, and the Department of the Purveyor-General ceased to exist. In 1871 purchase was abolished, and in the same year the foundation of an Army Reserve was laid by the institution of short service. The Army Hospital Corps, which was considerably augmented, came under the short service system seven years later, from which time onwards it was mainly maintained by direct enlistment. But the reform most profoundly affecting the Medical Service was the Warrant of March 1, 1873, abolishing all regimental hospitals except those of the Guards, and placing the medical officers in one department.[1] This was followed in 1877 by the transfer of command of the A.H.C. and patients in hospital from the officers of orderlies to the medical officers themselves, while the officers of orderlies reverted to the status of quartermasters.

The Army was not at this time well supported by the medical profession. The pages of the *Lancet* show that questions of pay, promotion and precedence were still being agitated. English and Scottish candidates for commissions were scarce, though there was an increasing flow of young graduates from Ireland. The Indian Medical Service, on the other hand, continued to attract excellent material.

The new system was somewhat gradually developed. The change was received by the officers of the Army Medical Department themselves with mixed feelings, and considerable opposition in high places demanded much tact and firmness on the part of the Director-General. Many surgeons, though no longer regimental, remained attached to their old corps, and for some years were permitted to attend their own patients in separate wards of the new station hospitals.

An experimental Field Hospital appeared in the autumn manœuvres of

[1] The strength of the A.H.C. in 1875 was 21 officers of orderlies, 264 W.O.'s and serjeants, and 1,060 O.R. There were 1,107 medical officers, of whom 476 were at home, 130 in the Colonies and 501 in India.

1872. A notable event was the publication in 1877 of an establishment for a Bearer Company with a scale of personnel, equipment, and transport. The first was to come from the A.H.C. and Medical Reserve Militia, largely supplemented by untrained infantry reservists. The transport, though calculated, was not definitely allotted before the South African War of 1899, as the Medical Service found to its cost. The removal of the A.H.C. Depot from Netley to Aldershot with a medical officer in command, which took place in 1875, inaugurated an era of real practical training in technical duties in the field.

The augmentation of the British garrison in India following the Mutiny necessitated a great increase in the medical staff. The I.M.S. superintending surgeons were relieved of all duties connected with British troops, which were transferred to Administrative Officers of the British Service. As a result, up to the year 1882, when the districts were portioned out between the two services, each General had two medical advisers, one for British, and one for Indian troops. The head of the British Medical Service, styled *Inspector-General of British Hospitals*, was not at first attached to Army Headquarters. Later as *Surgeon-General with the Government of India*, he joined the staff of the Commander-in-Chief, a position he held until the Esher Reforms, when he was put under the Adjutant-General.

Cholera in the 'seventies remained a serious menace. Koch's researches were not given to the world till 1883, when they took some time to absorb. Sir Walter Ogilvey has recently shown us that the Bengal Army Regulations of 1882 attempted in an appendix of fifteen pages to formulate precautions involving the acceptance of no less than five different theories of the disease. Health preservation still took second place to the cure of the sick in the list of the medical officers' duties. Until after the Second Afghan War, there were neither station hospitals nor women nurses in India.

Canada, 1870.

In 1870 Louis Reil's rebellion in Lower Canada necessitated the despatch of the Red River Expedition to Fort Garry, now the city of Winnipeg. The column, consisting of some 1,400 men of the 60th Rifles and Canadian Militia, was under the command of Colonel Garnet Wolseley, then D.Q.M.G. at Montreal. The operation involved a rail and steamer journey of fifty-two miles followed by a journey in boats and canoes for 600 miles through a wilderness of rivers, lakes, forests and rocks, where all supplies, even of food, had to be carried, being frequently borne on the soldiers' backs for many miles over difficult portages. The expedition, which was a triumph of efficient organization, was bloodless. Surgeon E. M. Young and Assistant-Surgeon W. Oliver, both of the 60th, were the medical officers.

Wolseley went to the War Office the following year, and, from that date until he retired as Commander-in-Chief in 1901, his influence was predominant in all matters of internal economy and the working out of the Cardwell System. In his relations with the Medical Service his

youthful experiences in the Crimea had no doubt impressed him with the evils of civilian control in the ancillary services of the Army, and he gave small encouragement to proposals extending the scope of the doctors much beyond the treatment of the sick and wounded. In his refusal, when commanding in the field, to recognize the Principal Medical Officer as even an appendage to his staff, or to afford him information on impending movements, he hindered the efficient working of the Medical Service. His supposition that its officers were incapable of controlling the organization and discipline of their field hospitals, after-events proved to be mistaken. As regards sanitation, he seems to have considered that so much of that art as was applicable in the field could be applied by any combatant official of military experience, an argument which could have been used with greater force at a later date when the elements of the subject had become part of the military curriculum. Insomuch, however, as it emphasized the principle that a study of hygiene was the duty of every officer and soldier, it was all to the good. For the specialist sanitary officer he had no use,[1] though he held the enlightened view that every medical officer should be a sanitary officer.

The restrictions Wolseley would have imposed on the surgeon's status and activities over and beyond his purely professional work may or may not have been best suited to the army of his day. Medical opinion, at any rate, thought not.

THE ASHANTI WAR, 1873-74.

The British connection with the Gold Coast dates from the reign of Charles II. In 1807 an Ashanti invasion of the Fanti territory, in which the British factories lay, brought the African Company in collision with the rising power centred at Kumasi, some 150 miles from Cape Coast Castle. There was a second invasion in 1817, and in 1824 the Crown assumed charge of the Protectorate. Shortly afterwards the Governor, Sir Charles Macartney, who took the field with a small detachment of British troops, was defeated by the Ashantis, and his head borne in triumph to Kumasi. Cape Coast Castle was beseiged but successfully defended and, in 1826, the enemy was signally defeated at the bloody battle of Doodwa. The credit for the preservation of the Colony rested with a penal battalion, the Royal African Corps, which was maintained as a garrison by the Government under most distressing conditions. The annual average mortality among the men of this battalion was between seventy and eighty per cent. The Protectorate was handed over to a second African Company in 1828, but in 1843 became a Crown Colony. When, in January, 1873, a great Ashanti

[1] Sir William Macpherson has suggested that Lord Wolseley's attitude towards the sanitary officer and all his works was influenced by Clausewitz, then newly translated. Clausewitz wrote (1827) that the theory of sanitary measures has not such an influence on strategic decisions as to make it worth consideration in the theory of war.

army crossed the Prah River, the British garrison consisted of a detachment of the 2nd West India Regiment.

For some months the brunt of the invasion was met with varying success by the local forces and a handful of Royal Marines, till the Government decided on the despatch of Sir Garnet Wolseley from home with an expeditionary force. He landed at Cape Coast Castle on October 2, where, besides the Naval Brigade and the W.I.R., he found a number of Hausa auxiliaries which were formed into regiments. The British troops disembarked were the Royal Welch Fusiliers, the 42nd (Black Watch) and the 2nd Rifle Brigade. The country consisted of a succession of rounded hills of moderate elevation intersected by narrow winding valleys, the whole covered by dense bush but with occasional tall trees. The town of Cape Coast was described by the newly-arrived Governor the year before as the most filthy and apparently neglected place he had ever seen under a civilized government. The dry season, when the temperature ranged from 72° to 88° F., was from mid-December to the end of March, when the greater rains began to make the country notoriously unhealthy. It was decided that an advance to Kumasi must be undertaken as soon as possible.

During the first three months, in which the Royal Engineers were engaged in improving the track from the base to Prahsu on the Prah River, a distance of sixty-nine miles, there were some small affairs with the enemy and considerable sickness. A large medical staff was sent out, comprising 73 surgeons and 3 officers and 261 other ranks of the A.H.C. The P.M.O. was Deputy-Surgeon-General Anthony Home, who had won his V.C. at Lucknow when surgeon of Wolseley's regiment. The latter described him as "One of the ablest and most hard-working military doctors I ever knew; a man who never spared himself in any way; as remarkable for his coolness under fire as for his medical skill." He wore himself out before the final advance took place, and, having seen Sir Garnet through a dangerous bout of fever, had to be invalided home. He was succeeded by Surgeon-Major W. A. Mackinnon, a brother officer of the New Zealand War and a future Director General.

Two hospital ships were employed, the *Simoon* and the *Victor Emmanuel.* The last, a wooden screw line-of-battle ship, providing 240 beds, was used as a base hospital. The *Simoon,* anchored at St. Vincent in the Cape Verde Islands, received drafts of invalids who were later transferred to homeward-bound Cape liners.

Special clothing was provided for British troops, described as a grey tweed shooting-jacket with trousers and belts of the same material. Rough canvas leggings were worn and an Indian pattern helmet. Some sensible instructions on disease prevention were issued, including an order that a hot meal was invariably to be served in the early morning. There was an evening issue of a half-gill of rum. All drinking water was supposed to be "filtered."

In January, 1874, Wolseley commenced his advance on Kumasi. The

Prah was reached in eight marches, and was crossed on the 20th. A mobile field hospital in charge of Surgeon-Major Jackson accompanied the column, the sick transport consisting of cots carried by native bearers.[1] These bearers were apparently not under the direct control of the Medical Department. There were six bearers to each cot. A second field hospital was established at Insarfoo, on the L. of C., with Surgeon-Major Elliot in charge.

On January 31 a somewhat severe engagement was fought at Amoaful, in which the force suffered 250 casualties. A loose, square formation, afterwards used in Egypt and the Sudan, was employed on this occasion. On February 1, Becquah was captured, and on the 4th Wolseley entered the capital. Rain now commenced to fall, and, as the King delayed coming to terms, and much sickness might result from further delay, the town was fired and the place evacuated. On the return journey King Koffee appeared and made his submission. During the whole march there were 269 battle casualties and 8 deaths. The enemy fired mainly slugs, or the mortality might have been higher. There was considerable wastage from malaria. Prophylactic doses of quinine were given daily, but the P.M.O. formed little opinion of their value. During the eight weeks the British troops were on shore, 71 per cent. went to hospital on account of sickness. There were 70 deaths, 17 being due to enemy action.[2]

The following officers received decorations or special promotion for this campaign: Deputy-Surgeon-General Anthony Home, V.C. (K.C.B.), Surgeon-Major W. A. Mackinnon, J. A. Woolfreys, R. W. Jackson (C.B.), C. B. Mosse (C.B.), A. A. Gore (wounded), S. Rowe (C.M.G.).

Even in its worst days there was no lack of officer volunteers, either combatant or medical, for service on the West Coast. Several were able and devoted men. M. Colbey, who visited Sierra Leone in the latter days of the eighteenth century, paid a high tribute to the skill of the British doctors and their researches in tropical disease. William Freeman Daniel, who entered the Army Medical Department in 1841, and spent all his early service there, was a well-known botanist as well as a contributor to medical literature. Staff-Surgeon Samuel Rowe, mentioned above, who was one of those who went through the war from the beginning, had been on the Coast for the best part of eleven years. His extensive knowledge of the natives was invaluable, especially in enlisting men of the Yoruba tribes. He left the Service in 1876 to take up the Governorship of Gambia, and, between that date and his death at Madeira in 1888, held other charges in West Africa. He received the K.C.M.G. in 1880.

[1] The usual form of conveyance on the coast was a hammock supported by a bamboo pole on the bearer's heads. The Ashanti cot was an improvement on this, being a hammock stretched on a light wooden frame.

[2] W. W. Claridge: "History of the Gold Coast."

Travel.

BY RAIL AND ROAD IN INDIA.

By Major L. B. CLARKE,
Royal Army Medical Corps.

(*Continued from vol. lviii, page* 464.)

III.—The North.

At Kohala is the bridge crossing the river, and beyond is the toll post of Kashmir. To the left is India, to the right Kashmir. One now enters the Maharajah's dominions, and for the next hundred miles climbing gradually upwards, the road cut out of the steep mountain side never leaves the valley, and with raging torrent below and a limited expanse of sky above continues on its way and finally after many tunnellings, twistings and turnings emerges into the open country of the Vale of Kashmir. The gorge through which the road passes is about 100 miles long, and there must be few parts of the world where a mountain pass achieves such length.

The Customs post at Domel was found to resemble a railway station with covered roof, and on each side were long counters resembling platforms. Here full particulars were taken of incoming travellers and certificates produced that one was free from tuberculosis.

The landslide further on was negotiated with extreme care over a soft bumpy surface on which many coolies were working in their endeavour to shore up the road and prevent further falling of soft red scree. How the road continues to exist at all is a matter for conjecture, for in this part there are no rocks to afford stability. The road is carved out of the softest and most crumbling earth imaginable, an easy prey to the frequent violent rain storms of this part.

At Baramulla (134 miles), the first town within the Vale, a houseboat brought down by an officer friend from Srinagar, was waiting, and here one embarked on a fifty-mile tour. The Kashmir houseboats are complete travelling houses fitted up with sitting-rooms, dining-rooms and bedrooms; the man in charge arranging everything, from the food you eat to the coolies who pull you along. Behind is the cook boat, where meals are prepared and the servants and crew and their family live, and behind again is the shikara or dinghy.

Slow and picturesque progress is made along the winding Jhelum, soft shadows of the higher peaks caress the verdure of the valleys, and

at every turn the outline of some graceful hill is mirrored in the calm waters of a lovely stream. Ranges of hills rising to a height of 3,000 feet above the river surround the Vale on every hand. Great white markings in V's, W's and Y's indicate the still lingering snow in the nullahs on the upper slopes of the Pir Panjal. Long avenues of silver poplars show the direction of the main roads. Herons and wagtails, kingfishers and golden orioles, winding stream and open lake, profusion of tree and flower, groves of walnut and chenar, and every scene is an artist's picture.

By easy stages our way was gradually directed towards Srinagar, the capital, but a diversion was made to Gandabal up the Sind River, a tributary of the Jhelum, and here a couple of nights were spent. A good mooring

Fig. 2.—Gandabal Bridge, Kashmir.

place was found above the bridge and some time was spent in waiting for the rain to stop.

Behind the small town is the entrance to the Sind Valley, and here could be seen disappearing into the obscurity of the valley mists the first stage of the long trail leading towards Ladakh, the world's highest inhabited region, and mysterious far-off Tibet.

There was some doubt as to whether fishing was allowed at this season, but one's companion was prepared to take the chances, for everywhere there were signs of many fish. The new bearer, taken on before leaving for Lahore, although somewhat uncertain of his English, had no doubts on this subject, and said more than once that there was "Plenty good fish shooting." As one was having one's evening bath he rushed to the door

and announced, "Sahib, shot a fish." "What with, a rifle?" he was asked. "No, no, shot a fish."

The next day he excelled himself. Tea was ordered on the river bank and chairs and tables were placed beneath a shady chenar tree. As he was moving a small table from the bedroom he overlooked the fact that the lower edge was supporting his master's Gillette razor, which thus fell into the river. Attempts were made with rolled-up sleeves and raised lower garments to secure the lost razor, for sahib's temper was uncertain and there would be much trouble in store if it were not found. It was embedded in the mud and the only solution was to procure a sort of shrimping net used by the local fishermen, and with this contrivance the razor was retrieved. Discreet inquiries from the boat staff revealed that he had given one rupee "backsheesh" to the fisherman, and so he had to pay somewhat dearly for his carelessness.

At another mooring place the boat came to rest beneath the overhanging branches of a great chenar groove. This was one of the mooring places belonging to the Maharajah, and soon after our arrival a gentleman wearing some sort of semi-uniform came and paid his respects, and amid many salaams and desires for our future prosperity demanded a mooring fee of one rupee. He was asked to produce his receipt book, and on hearing this vanished into thin air and was not seen again.

The next day a carpet and silk merchant arrived on the scene, and in the middle of a crowd of small grimy urchins who persistently demanded "paisa" commenced to unfasten his numerous packages. He was informed that it was no good, the sahibs did not wish to purchase anything. He, however, continued his unpacking with the persistence of the East, and when told to go away said, "Sahibs no buy, just look see." He was again warned to clear off. He took no notice of this and started to walk to the gangway to the boat. Some experience had been obtained of this particular gangway. It was very narrow, very slippery and was by no means securely fastened to either bank or boat. He was told on no account to cross the gangway, as he would fall in. This, apparently, he regarded as the Sahib's little joke, for he took no notice of repeated warnings, and with armfuls of costly silks and a couple of carpets balanced on his head he set foot on the plank and was immediately precipitated into the slimy mud of the Jhelum. A sadder, wiser and dirtier carpet wallah retired crestfallen to the bank, and with ill-concealed surprise at the ways of the sahib betook himself and his goods back to Srinagar.

A car with driver in attendance on the houseboat is a great asset to one's stay in Kashmir, and at every stop the car was brought round by some odd track or road to the mooring place. In this way several excursions were made to Srinagar, and as we gradually worked our way nearer to the city more and more time became available for seeing its sights.

Srinagar is quaint and interesting with, many solid and substantial houses. The river is crossed by seven bridges of wood, and at the Bund

with its big houseboats resembles the Isis at Oxford. The European part of the town is beautifully laid out with fine avenues, parks and a big polo ground. There is a large European hotel, Nedou's of Lahore, and the English visitors who stay here and in the houseboats are very numerous.

Two steep hills dominate the town, the Tukt-i-Sulieman surmounted by an ancient temple, and Hari Parbet by a fort. To one side of the town is the celebrated Dal Lake, one of the world's most beautiful scenes, and dotted along the placid waterways can be seen great numbers of houseboats. Scurrying here and there are shikaras, gaily decorated and comfortably cushioned taxi-boats, rowed by four men in the stern. Spreading along great stretches of the lake are the famous floating gardens where thick mud

Fig. 3.—The Dal Lake, Kashmir.

supported by rushes forms a fertile soil for the growth of melons, tomatoes, cucumbers, etc.

The first visit to Srinagar was noteworthy for a picturesque scene at the south end of the lake where ornate white shikaras came slowly into a private pier, and from the first was seen landing the Maharajah and his retinue. They entered elaborate Rolls Royces and drove slowly along the lake side.

Beyond the silvered waters of the Dal Lake where sloping hill sides reach the shore is a great walled enclosure with stately trees rising on each side, and within is the Shalimar Garden, famed in song and verse. Here flowers of exquisite beauty grow between lawns of velvet, and down the middle runs an ornamental stream rising from the heights above. A long straight canal, bordered by shady trees, the home of thousands of ducks

and geese, leads from the lake to the garden and forms a ceremonial approach which in Moghul times must have been the scene of many a royal visit.

Many days can be spent on the Dal Lake, the scene changing according to the light and shade, and wherever the eye may rove is some enchanting picture.

Kashmir is noted for many local productions, the best known, of course, being the woollen shawls. These are made from the soft down beneath the neck of the wild Tibetan goat. Walnut wood-carving and lacquer work are also carried out on a large scale. The former is well done and always worth studying, but the latter is inartistic and tawdry and bears no comparison with that done in Burma. It is sheer waste of money to buy lacquer in Kashmir.

There is a certain fascination in making purchases in the East. It is also somewhat of an art. Never hurry, never praise the article desired, never appear to want it particularly, never confine attention to any one line of goods, never accept the man's first price nor his second, never remain in the shop too long, but at the psychological moment walk away as though the deal were off, and he will almost certainly pursue you into the street and there accept your last offer. Even then you may be sure he will get a handsome profit.

Between the Post Office and Nedou's Hotel is a row of curio shops. With plenty of time on hand we entered one of them. Wood-carving was shown, a price asked, an offer made, a big discrepancy revealed, aspersions cast on the quality of the goods, a renewed and slightly higher offer, and then the remark "You no joke me." After several financial skirmishes the engagement was broken off and twice the quantity of wood-carving was subsequently secured at a neighbouring factory at approximately the same price.

Next door was a general curio shop. One entered and was received by the bearded owner with deep salaams, hand raised to head and body stiffly inclined from hips. "Salaam, Sahib". "Salaam." "What may the Sahib wish to see?" "Let me see the most expensive thing you have in the shop." "Oh, Sahib," and breathing deeply he produces a gorgeous Persian carpet, reputed to be 300 years old. "How much?" "2,000 rupees." "What! for a kutcha thing like that. Why, it's been repaired in several places." Then follows a long explanation of its history and quality, probably improvised. Realizing the hopelessness of the situation he resigns himself to the inevitable and asks what else he may have the honour of showing. "Now show me the cheapest thing you have." With a look of disappointment he produces a small artistically embroidered bag at one rupee. This appears to meet the financial position more closely. With these two extremes disposed of, one was then prepared to examine in detail his general stock.

Numerous carpets, shawls and silk embroidery caught the eye. One

carpet, a Shiraz, took one's fancy and one inquired the price. "200." "Too much. I would give you 50 for it, nothing more." "Oh, Sahib. I do small business. I am poor man with large family." He is assured that the sahib has heard previously of the reputed size of carpet wallahs' families and with a shrug of the shoulders he places the carpet on one side. Next Kashmir shawls and wraps are examined, beautiful artistic work of the softest texture imaginable. A shawl and a wrap are ordered to be put on one side. These are 85, but of course too much and he is duly informed of this. He is then asked to what extent he will reduce the carpet at 200 and the other two articles at 85, if all three are purchased. 250 is suggested; again too much. After some discussion as to the inclusion of a small bag at one rupee and the suggestion that all these could be bought more cheaply at another shop his price actually comes down to 200. He realizes that a number of articles may be bought if he is only reasonable enough and with visions of a competing shop which he is not allowed to forget he drops to 175. Still nothing doing and an attempt is made to leave the shop. He at once comes down to 150. No, that won't do at all. He will have to include for this figure a small embroidered tea-cosy at one rupee in addition to the bag. He is then informed, with a wave of the cheque book, which acts like magic, that a perfectly good cheque will be given him at once for 150. He then shrugs his shoulders again and gives in, but as the cheque is to be made payable for the current date, a perfectly good cheque on the best bank in India and he can get it cashed at once, he had better throw in two pairs of walnut-wood nut-crackers at four rupees each. He appears hesitant and bewildered and is much afraid the blue cheque book will disappear into the sahib's pocket, and he becomes more amenable and throws a pair of nut-crackers on to the pile of goods. As the cheque is handed to him the second pair of nut-crackers are very gently removed from his hand and join the first pair. And so the deal is done and purchases made at 150 of a Shiraz carpet, a Kashmir wrap and shawl, a bag, a tea-cosy and two pairs of nut-crackers, whose original price was 295. The ways of the East are tortuous, the journey long, but somehow or other one gets there.

Before leaving Srinagar a run was made to Islamabad, and to the foot of the Banihal Pass at the far end of the Vale. Here the road to Jammu, Lahore and the south climbs to a height of 8,500 feet, and in the winter is closed on account of snow.

The last morning in Kashmir was spent in a short run to Tanmerg, at the foot of Gulmerg, the hot weather station for Kashmir. There was not time to go to the top, but a superb view was seen of Nanga Parbet towering over the northern ridge of the Vale. Here, at nearer view, it is even more majestic than when seen from the Murree Hills. Its great triangular, snow-covered summit, forms a fitting crown to India's most charming State.

The journey back of 168 miles was hot and uneventful save for the escape from a falling rock which missed the bonnet by inches. Within a

few weeks of one's return the monsoon broke, the road went in several places, a span of the Kohala Bridge collapsed and the road was temporarily closed to all traffic. Travellers had to leave their cars at Kohala, walk a plank bridge over the river, and enter hired taxis on the other side. One felt thankful that our trip had been taken at the right time.

Burma and Kashmir are reputed to be the most beautiful countries in the world, and as this narrative includes each, the question may reasonably be asked as to which bears the palm. Burma has a hot and sticky climate, Kashmir a wet and variable one. Each depends for its great charm on vistas of hill and water. This is the predominant feature of the scenery, and it is very difficult to say which country is the finer. It may perhaps be put in this way: Burma's landscape is a study in soft gold, Kashmir's in clear silver.

As regards the inhabitants, there is no doubt whatever. In Burma a beautiful country produces a strikingly handsome people, and their dress is a reflex of their country's charm. In Kashmir one is disappointed to find that the people are singularly unattractive both in their features and dress, the coarse dull clothing of the women being the only blot on an otherwise fair and charming landscape.

The industry of the two peoples, however, is in inverse ratio to their charm, for whereas the Burman loathes work and always avoids it, the Kashmiri is never idle. The Burman lives in a land where it is "always afternoon." The Kashmiri has to put up a fight against floods and cold at a height of 5,000 feet, and cannot indulge in the lotus existence of a southern climate.

In a few months' time a "five-year Indian tour" was concluded; this had included a considerable part of a great sub-continent and a circuit of the globe, together totalling 30,000 miles by ship, 14,000 by train, and 22,000 by car.

And so in a few short years journeys are made by water, rail and road, through many distant lands whose closer acquaintance increases one's knowledge, broadens one's views and brings some measure of understanding to their various characteristics and problems.

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Current Literature.

PATTON, H. W. **A Simple Colorimetric Method for the Determination of Potassium Iodide in the Blood and Urine.** *U.S. Naval Med. Bull.*, 1932, xxx, 214.

The author of this paper, Lieutenant Patton of the United States Naval Medical Corps, states that primarily this is a test for iodine and therefore is equally applicable to all substances liberating free iodine, that the standards given represent iodine expressed as potassium iodide, and that in testing for other iodides the factor representing the difference in the ratio of iodine would have to be taken into consideration.

Large doses of potassium iodide, administered over prolonged periods, are often used in the treatment of syphilis. The drug is usually readily excreted through the kidneys, but occasionally a patient is met with who retains iodides in such a degree that there is a danger of iodism if the usual doses are given. In those patients with an impaired iodide excretion small doses will give the same result as larger doses in normal individuals.

The author describes his method of estimating the iodide content of the blood and urine as being simple, fairly accurate and requiring no laboratory equipment or reagents other than those usually available. More precise and complicated methods are mentioned by the author, but he thinks that the degrees of accuracy obtained by these are not ordinarily required.

All workers are stated by the writer to be agreed that iodide excretion is hindered chiefly by lesions of the uriniferous tubules, and it is in such patients that preliminary excretory functional studies should precede heavy iodide administration.

Lieutenant Patton's method is as follows:—

For Urine.

(1) Place two cubic centimetres of urine in a ten cubic centimetre test-tube identical with the standard tubes (see below).

(2) Add $\frac{1}{10}$ cubic centimetre of concentrated hydrochloric acid.

(3) Add one cubic centimetre of hydrogen peroxide.

(4) Add two cubic centimetres of chloroform.

(5) Stopper and roll the tube slowly backwards and forwards across the table until the maximum colour has developed. Avoid violent agitation, which tends to emulsify the chloroform and aqueous layers.

(6) Compare after ten minutes with standard tubes.

In cloudy urines or those containing large quantities of albumin it may be necessary to first heat and filter, having acidified the specimens with concentrated hydrochloric acid.

For Blood.

(1) Take ten cubic centimetres of citrated whole blood.

(2) Add nine cubic centimetres of distilled water.

(3) Add one cubic centimetre of saturated solution of trichloracetic acid.

(4) Shake for three minutes in a stoppered Florence flask and filter.

(5) Proceed as in the urine test, using twice the quantity of filtrate (four cubic centimetres) and omitting the addition of hydrochloric acid.

PREPARATION OF STANDARDS.

Select twenty 10 cubic centimetre test-tubes of uniform size, to each add the amounts of 0·1 per cent potassium iodide and distilled water shown in the table. Then add to each tube 0·1 cubic centimetre of concentrated HCl, 2 cubic centimetres of chloroform and 1 cubic centimetre of hydrogen peroxide.

Tube No.	Milligrams of iodine as KI per c.c.	KI 0·1 per cent. solution	Distilled water
		c.c.	c.c.
1	1·0	2·0	0
2	0·9	1·8	0·2
3	0·8	1·6	0·4
4	0·7	1·4	0·6
5	0·6	1·2	0·8
6	0·5	1·0	1·0
7	0·4	0·8	1·2
8	0·3	0·6	1·4
9	0·2	0·4	1·6
10	0·15	0·3	1·7
11	0·1	0·2	1·8
12	0·09	0·18	1·82
13	0·08	0·16	1·84
14	0·07	0·14	1·86
15	0·06	0·12	1·88
16	0·05	0·10	1·90
17	0·04	0·08	1·92
18	0·03	0·06	1·94
19	0·02	0·04	1·96
20	0·01	0·02	1·98

The twentieth tube should show no perceptible colour. Dip the stoppers in melted paraffin, withdraw as much air as possible from the stoppered tubes with a hypodermic needle inserted through the stoppers, and dip the upper half-inch of the tubes in melted paraffin. Standards thus prepared will not deteriorate appreciably in three to four months. Each tube is marked with the number of milligrams of iodine expressed as potassium iodide per cubic centimetre of chloroform (half the amount added to the tube), so that readings are made directly in milligrams of potassium iodide per cubic centimetre of blood or urine. No computation is required. The method is capable of detecting ten parts per million or $\frac{1}{1000}$ of one per cent of potassium iodide.

The author believes that his estimations will prove of practical value to clinicians prescribing iodides, and will help to prevent serious symptoms of iodism in patients with impaired function; the test may also be useful in cases where there is doubt as to whether patients are actually taking odides as prescribed.

COOKSON, H. A. **Complement Fixation in Meningococcal Infections as an Aid to Diagnosis.** *Edin. Med. Journ.*, 1932, xxxix, 258.

The writer considers that septicæmic and abortive types of meningococcal infections are commoner than is generally supposed, and that in such cases the cerebrospinal fluid may be clear, with no cell increase, and culture may be negative. In such cases a complement-fixation test might be of value.

The method employed is practically that of No. 1 Wassermann technique, Medical Research Council, using as antigen a phenolized saline suspension of 250,000,000 meningococci per cubic centimetre. The writer tested a "residual antigen," which he found to be more sensitive but less reliable than the other antigen.

The results obtained in various series of cases are given. In the first series there were twenty cases of cerebrospinal meningitis in which meningococci were found in the cerebrospinal fluid. One gave a negative reaction when tested on the seventh and fourteenth days of the disease, two gave "a trace," while the other seventeen gave positive or strong-positive reactions, the cases varying from the sixth to the nineteenth day of the disease.

In the second series there were fourteen cases in which meningococci were not found in the cerebrospinal fluid, but clinical or cytological evidence, or both, suggested a meningococcal infection. Nine of these gave positive or strong-positive reaction, four gave a trace, and one was negative.

A group of fifty sera giving positive Wassermann reactions was tested. All were negative except one, which gave a strong-positive reaction. No information was obtained about this positive case.

Of twenty-five gonorrhœa patients examined a positive reaction was obtained in one.

Then fifty sera were obtained from various sources, three being from cases of tubercular meningitis and two from pneumococcal meningitis. All gave negative results.

The writer considers that the test may be of value when the results are considered along with the clinical condition. He is of opinion that in a doubtful case, if the cerebrospinal fluid shows polymorphs, not much decrease in chloride and a positive complement-fixation test, the disease should be regarded as a meningococcal infection.

DYER, R. E., CEDER, E. T., WORKMAN, W. G., RUMREICH, A., and BADGER, L. F. **Transmission of Endemic Typhus by Rubbing either Crushed or Infected Fleas or Infected Flea Fæces into Wounds.** *Public Health Reports* (U.S.A.), 1932, xlvii, 131.

Since 1930 the writers and other officers of the United States Public Health Service have been investigating the transmission of endemic typhus by the rat flea, *Xenopsylla cheopis*, and the results of various experiments have been published in the *Public Health Reports* from time to time.

The virus was first recovered in 1930 from fleas taken from wild rats in Baltimore in a focus of endemic typhus. Experiments were then made in infecting rat fleas by placing them in cages with white rats which had been injected with typhus virus. After two weeks' contact with the rats, fleas were removed, emulsified in saline and injected into two guinea-pigs, one of which developed typhus, and from this animal the disease was transmitted by injection into guinea-pigs and rabbits through three generations. Two rabbits when tested showed agglutinins for *B. proteus* X_{19} (type O). Such transmissions were repeated later.

In further experiments it was found that the disease could be transmitted by injecting into guinea-pigs a saline emulsion of the fæces of rat fleas which had become infected by feeding on typhus-infected rats.

In other experiments infected fleas, placed in test-tubes the mouths of which were covered with chiffon, were allowed to feed on healthy guinea-pigs, none of which became infected.

In the experiment recorded in the present paper, fleas which had fed on rats suffering from endemic typhus were crushed in a mortar and were then smeared on the shaved abdominal skin of two guinea-pigs. The smeared area was then scratched with a sharp piece of iron, and collars were fitted on the guinea-pigs to prevent them licking off the crushed fleas. Both animals developed febrile reactions, but no scrotal involvement occurred. The guinea-pigs were killed on the eleventh day, and eight healthy guinea-pigs were inoculated from brain and spleen emulsions. Of these animals, five developed typical typhus, Rickettsia bodies being seen in smears made from the tunica vaginalis.

Similarly, two guinea-pigs were smeared with fæces of infected fleas and the smeared areas were scratched. One guinea-pig developed some fever, but no other signs of illness, and the other appeared normal; both were killed after thirteen days, and brain and spleen emulsions were injected into eight healthy guinea-pigs, five of which developed the febrile reactions and scrotal lesions of typical endemic typhus.

In both these last experiments further tests were made to verify that the typhus produced was the true disease; sections of brain were examined and the characteristic histological changes of typhus were seen, rabbits were inoculated and developed agglutinins for *B. proteus* X_{19}, and guinea-pigs immune to typhus were found to be immune to the virus in these animals.

Reviews.

HEALTH IN HOT CLIMATES. B. J. N. Dugdale, M.B., Ch.B. Second Edition. London: John Bale, Sons and Danielsson, Ltd. 1931. Pp. 189. Price 5s. net.

It is a never-ceasing source of surprise to those of us who spend our lives in hot climates to note how ignorant of matters of tropical hygiene is the average civilian arriving in the tropics. An hour's talk, prior to leaving home, with a well-informed medical man with tropical experience would be the ideal preparation for the new conditions; this is seldom practicable, hence the function of such a book as this, which serves as a good substitute. It deals with the simple principles of how to avoid disease, and also gives some idea to those living some distance away from a qualified doctor as to what to do in cases of sickness until assistance arrives.

It is a handy little volume that will repay perusal.

INDIVIDUAL SEXUAL PROBLEMS. By F. G. Crookshank, M.D., F.R.C.P. (Psyche Miniature Medical Series.) London: Kegan Paul, Trench, Trübner and Co., Ltd. 1931. Pp. 150. Price 2s. 6d. net.

Dr. Crookshank in this small book endeavours, with some success, to trace the fundamental nervous origins of the main classes of perverted sex impulses and manifestations. The explanatory theories of Freud and Adler, as applied to such problems, are analysed and explained.

The writer holds strong views of his own as to the underlying causes of abnormal states met with in general practice. Whether or not one agrees with all his conclusions, there is much strong common sense in his views on the upbringing and instruction of the young in sex matters.

The book is a useful and thoughtful work which should be of value to parents and medical men alike. P. C. F.

FLATFOOT. The True Nature, Cause and Rational Cure. By S. D. Fairweather, M.A., M.B., Ch.B. (late Captain, R.A.M.C.). London: John Bale, Sons and Danielsson, Ltd. 1932. Pp. viii + 76. Price 7s. 6d.

The subject of this little book necessarily concerns all officers of the Corps very greatly, and its contents, with the many clear illustrations, will well repay study. The author, by sound reasoning and argument, elaborates his theory that the principal underlying cause of flatfoot is not so much ill-fitting footwear, but almost entirely the "elevation of the heel" by ill-advised forms of boot or shoe. Static balance is disturbed, and as a result one of the opposing group of muscles supporting the arches loses its tone, because it is placed at a disadvantage, while the over-used

opponents are over-developed. A few quotations will suggest food for thought.

"The weakness in flatfoot does not lie in the calf muscles. . . . Dancing mistresses, tip-toe dancers and racing cyclists are very apt to get flat-footed, in spite of huge calf muscles and well-developed *peronei longi*, and it is common experience that standing tip-toe exercises fail to cure flatfoot."

"The present method of testing for flatfoot, i.e., asking the patient to stand on tip-toe, is no criterion of the efficiency of the arch. . . . The true test of the efficiency of the arch is that a person standing erect on one foot can increase and diminish the curvature at will by contracting and relaxing the arch-supporting muscles."

"In the Army also, men are trained to stand 'at ease' with the feet at an angle of 45 degrees and the weight of their bodies and equipment equally divided between heels and toes, that is, resting on the arch. No wonder then, that at least ninety per cent (? reviewer) of the Army are more or less flatfooted."

"The heel was designed to bear practically all the body weight when standing, and the forepart of the foot for locomotion. . . ."

Proper attention is drawn to the strong well-developed foot of the barefooted savage, and to the evil of toes pinched to a fashionable point by "smart" shoes and tight, shrunken socks. The author then goes on to describe his heelless shoe and its effect on foot and leg development; this he says is necessary to comfort or recovery from the deformity once developed.

In his foreword, Sir Robert Jones says: "The difficulty he will find will be in defeating the habit of centuries of fashion. . . ." Yes—indeed, what *will* our lady friends say? On the other hand, some of the flatfooted ones are too busy groaning over foot arches and other apparatus to say much. D. C. M.

SYNOPSIS OF MIDWIFERY AND GYNÆCOLOGY. (Fifth Edition). By Aleck W. Bourne, M.A., M.B., B.Ch.Camb., F.R.C.S.Eng. Bristol: John Wright and Sons, Ltd. 1932. Pp. viii + 439. Price 15s. net.

This synopsis has succeeded admirably in its purpose.

The subject matter is well arranged under its respective headings and epitomizes the characteristics and the most modern treatment of the difficulties met with in obstetrics and the majority of gynæcological diseases. The information given is full and well considered, but sufficiently condensed in essentials to be of the greatest value to the practitioner.

The chapter on infective conditions of the female pelvic organs is specially noteworthy, and that dealing with embryology has presented this somewhat difficult subject to the reader in a compact and intelligible form.

P. C. F.

POCKET ATLAS OF ANATOMY. By Victor Pauchet and S. Dupret. Second Edition. London: Humphrey Milford, Oxford University Press. 1931. Pp. xiii + 377. Price 12s. 6d.

The publication of the Second Edition of this handy little Pocket Atlas on Anatomy, three years after the appearance of the first edition, with twenty-eight new plates, will be welcome alike to students and general practitioners and to those officers in the Corps who want to give their anatomy the usual "brush up."

All the diagrams are clear and well drawn and annotated, while the new index makes ready reference simple.

It is not everyone who can assimilate anatomical knowledge from diagrams, but for those who can, this handy little book can be thoroughly recommended. D. C. M.

WHEELER AND JACK'S HANDBOOK OF MEDICINE. Revised by John Henderson, M.D., F.R.F.P.S.Glas. Ninth Edition. Edinburgh: E. and S. Livingstone. 1932. Pp. xix + 654. Price 12s. 6d. net.

The publishers are to be congratulated on their choice of Dr. Henderson to prepare the new edition of this popular work, for while he has made a thorough revision necessitating many alterations and additions, he has managed to retain the familiar atmosphere of its predecessors.

Certain sections have been recast and rewritten, notably those on vitamins, on some of the gastric disorders, pernicious anæmia, arthritis deformans and encephalitis lethargica. A number of new sections have been introduced for the first time. Coronary thrombosis, branch-bundle block, syphilis of the stomach, hepatic efficiency and cholecystography, acute febrile poliomyelitis, narcolepsy and various types of neurosis have been included. In spite of its slightly increased size resulting from these additions, the volume remains as convenient to handle as ever.

Medical students of the present day will continue to find Wheeler and Jack as faithful and reliable a guide in their studies as did those of a past generation, thanks to the policy of the publishers in keeping it up to date. It needs no recommendation from us or anyone else; its reputation was established years ago.

TROPICAL HYGIENE MANUAL—BRITISH RED CROSS SOCIETY—No. 10. By Major D. T. Richardson, M.C., M.B., D.P.H., R.A.M.C. London: Cassell and Co., Ltd. 1932. Pp. x + 218. Six plates and 51 illustrations. Price 2s. net.

This small volume is the latest of the excellent series of elementary manuals issued by the British Red Cross Society.

The author points out in his preface that a book of this size cannot pretend to deal exhaustively with the vast field to which it applies, but it can, and does, give a thoroughly satisfactory guide to the traveller who visits the tropics for the first time.

During the pleasant hours spent in reading it even a medical man is driven to think how valuable much of the information supplied would have been to him during a first tour in the East.

The author is to be congratulated on his judicious selection of material, and on the pleasant manner in which he presents it.

One or two minor errors have crept in, e.g., on p. 109 the text describes a cold water grease trap with three baffle plates, while the figure to which reference is given only shows two. Again on p. 123 a reference is given to fig. 22, p. 24. This should read p. 124.

While it is somewhat unusual to find instructions for nursing in a manual of hygiene, the chapter on this subject by Miss M. E. Tippetts, R.R.C., should prove of great value to those who are likely to be at a distance from qualified aid.

Emphatically a book that should be read by everyone who intends to visit or reside in tropical or sub-tropical areas.

MEDICAL MEN IN THE AMERICAN REVOLUTION, 1775-1783. By Lieutenant-Colonel Louis C. Duncan, U.S. Army, retired. *Army Medical Bulletin*, U.S.A., 1931, No. 25. Medical Field Service School, Carlisle Barracks, Pennsylvania.

The contest known as the American Revolution, waged during the eight years 1775-83, is of enormous importance, not because of the size of the armies engaged, for they were small, but for the reason that here democracy gained the supremacy and, as a result, modern democratic government began.

Much has been written on this war of the revolution, but of medical details practically nothing. This book is of peculiar interest to us because it tells not only of the diseases which affected the armies, but shows what an important part medical men played in the American Revolution, both in the practice of their profession and as actual leaders on the field of battle; they seemed, indeed, to have been the mainstays of the young republic.

The author deserves great credit for producing a work of great historical interest.

A. C. H. G.

THE SOLDIER AND THE EMPIRE. By Captain F. P. Roe, F.R.G.S., Army Educational Corps. Aldershot: Gale and Polden, Ltd. 1932. Pp. xxiii + 282. Price 5s.

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THE VETERINARY BULLETIN, 1932. Published by the Imperial Bureau of Animal Health, Weybridge, Surrey.

This Bulletin is now issued monthly from January, 1932, and, including the Index, will run to about 864 pages for the year. It will cover the same ground as Vol. I, but will be much more complete and will include references to all important British and foreign scientific work relating to veterinary research, administration, public health and education.

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Correspondence.

PUBLIC HEALTH INTELLIGENCE OF THE HEALTH ORGANIZATION OF THE LEAGUE OF NATIONS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—May I, through the courtesy of your columns, bring to the notice of Public Health Administrators the facilities that exist in the Health Organization of the League of Nations for the supply of information relating to the detailed application of different public health methods in various countries. In addition, comparative information is available with regard to epidemiological statistics and public health legislation.

The Health Organization is willing to supply, as far as possible, data on the above branches of preventive medicine.

Inquiries are, however, limited to those from the heads of large administrations or the heads of scientific institutions, who should indicate the purpose for which the information is required in view of the amount of work that unconsidered requests necessarily involve. Furthermore, inquiries should be limited to information that is not already available in the medical press.

All inquiries should be addressed to the Medical Director, Health Section, marked "Public Health Intelligence," League of Nations, Geneva, Switzerland.

League of Nations,
Health Section,
Geneva, May 2, 1932.

Yours faithfully,
LUDWIK RAJCHMAN,
Medical Director.

Notices.

CATALOGUE OF THE PUBLICATIONS OF MESSRS. BAILLIÈRE, TINDALL AND COX.

WE have received from Messrs. Baillière, Tindall and Cox the May, 1932, catalogue of medical and scientific books published by them. This is a useful list of recent works, with a complete subject and authors' index.

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LIST OF BOOKS RECEIVED IN THE ROYAL ARMY MEDICAL COLLEGE LIBRARY

JANUARY 1 TO MARCH 31, 1932.

Author(s)	Title of Work	Grant or Gift
Ten Teachers	Midwifery	Grant
Carter	Yellow Fever. Epidemiological and Historical	,,
Indian Government ..	Fauna of British India. Pt. 3. On Coleoptera	S. of State for India
Purves-Stewart	Nervous Diseases	Grant
Harvard College, U.S.A. (Strong, Ed.)	The Harvard African Expedition. 2 Vols. To Liberia and Belgian Congo	Sir D. Bruce
Bishop	Arterial Sclerosis	Author
Pickett-Thomson ..	Annals of the Laboratory. Vol. VIII ..	Library and Journal Committee
Ministry of War (France)	L'Œuvre du Service de Santé Militaire en Algérie. 1830-1930	,, ,, ,,
Sinclair	Fractures	Grant
Colyer & Sprawson ..	Dental Surgery and Pathology	,,
Lines	Science of Meats. Vol. I	,,
Dodds & Whitby ..	The Laboratory in Surgical Practice	,,
Robertson & Porter ..	Sanitary Law in Practice	,,
Howe	Motives and Mechanisms of Mind	,,
Dible	Recent Advances in Bacteriology	,,
Short	An Index of Prognosis	,,
Bennett	The Science and Practice of Dental Surgery. 2 Vols.	,,
Myers	Modern Infant Feeding	Author
Ham	Handbook of Sanitary Law	,,
U.S.A. Congress Librarian	Report of the Librarian for 1930-31	Library and Journal Committee
St. Thomas's Hospital ..	Reports. Vol. LIII	,, ,, ,,
London Hospital ..	Researches for 1931	,, ,, ,,
Campbell	The Black Death and Men of Learning ..	Grant
Pelouze	Gonorrhœa in Male and Female	,,
Coyte	Surgery of the Genito-Urinary Tract	,,
Cheesman	Hunting Insects in the South Seas	,,
Knox (Livett)	Textbook of X-ray Therapeutics	,,
Strecker & Appel ..	Discovering Ourselves	,,
Forbes	Diphtheria Past and Present	,,
Konikow	Physicians, Manual of Birth Control	,,
Bourne	Synopsis of Midwifery and Gynæcology ..	,,
Ellman	Chest Diseases in General Practice	,,
Compton	The Genius of Pasteur	,,
Ditmar	Snakes of the World	,,
Birtwistle	A Descriptive Atlas of Radiographs	,,

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, Journal of the Royal Army Medical Corps, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the Journal of the Royal Army Medical Corps is £1 payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

Communications in regard to subscriptions, change of address, etc., should be addressed "The Manager, Journal of the Royal Army Medical Corps, A.M.D.2, War Office, Whitehall, London, S.W. 1."

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VOL. LIX. AUGUST, 1932. No. 2.

Journal

of the

Royal Army Medical Corps.

Original Communications.

FUNCTIONAL NERVOUS DISEASES IN THE ARMY.

BY MAJOR S. SMITH,
Royal Army Medical Corps.

IN approaching the discussion of the so-called functional disorders, or their modern equivalent, the psychoneuroses, we must be wary, for the subject bristles with difficulties and entails a consideration of that congeries of disorders, that half-way house between physical and psychical—considered by many to be wholly psychical—around the ætiology and causation of which so many theories have been woven and so little actually proved.

The psychoneuroses constitute a group which is common, and becoming increasingly common, in our post-war Army; not only do we meet with more cases, but far more interest is taken than formerly in the elucidation of the particular difficulties of environment, etc., from which these unstable individuals suffer, with, it is hoped, a correspondingly more sympathetic treatment of their varied disabilities, fancied and real.

This increase of interest may be put down largely, I think, to our war experiences gained at the neurological centres scattered throughout the various theatres of war and in Great Britain, in which medical officers and trained psychologists worked together to their mutual advantage.

During the student days of many of us disorders of the nature of hysteria were clear-cut clinical entities, possessing, so it was thought, definite signs and symptoms by means of which any competent practitioner could differentiate them from the "organic" group. Of recent years, however, this clinical barrier between "functional" and "organic" has been found to rest on no very sure foundation, and many so-called organic signs and

symptoms are now recognized to be closely mimicked by, if not identical with, those occurring in disorders of purely psychogenic origin—witness the psychogenic fit in which a whole host of phenomena, formerly only associated with organic or " essential " epilepsy, may occur.

It has been shown that a man may voluntarily so relax the muscles of his legs as to abolish temporarily his knee-jerks; during a temporary attack of coma, it may be of psychogenic origin, a double extensor plantar response may be elicited, never to recur; unconsciousness with dilated and fixed pupils may be met with as a direct and temporary result of fright; transient glycosuria is a common phenomenon in many of the neuroses. Examples such as the above could be multiplied with ease. Such conditions as "hysterical fever" and "hysterical diabetes" are, however, of doubtful ætiology, and it is uncertain whether these two phenomena are ever purely of psychic origin.

The use of the term "functional" disorders for the clinical group described in this paper, although possibly hallowed by long usage, is open to many obvious objections; and S. A. K. Wilson [1] points out, very cogently, that all diseases, whether they be psychic or physical in origin or both, are necessarily accompanied by alteration of function, whether that alteration be of excitation, of depression, or of extinction. In fact, there can be no disease without disturbance of function. As applied to the above-mentioned disabilities, the word functional is therefore entirely without meaning and, in his (Dr. Wilson's) opinion, should be dropped.

Concerning the relative importance to be attached to physical and psychical factors in determining the causation of the psycho-neuroses, the leaders in neurological thought are by no means agreed amongst themselves.

Many, chiefly of the Continental school, notably Freud and his two famous former disciples Jung and Adler, with their respective schools of psychology, look to a purely psychical basis for an interpretation of the entire disease group, only differing amongst themselves as to exactly what psychical factor is involved and how far one has to delve back into the patient's past history in order to find it.

The British school, on the other hand, or at any rate one very sane section of it, attach at least *some* importance to physical factors; many of them, the late Sir Frederick Mott amongst others, attaching special importance to the endocrine system, especially the gonads, in the causation of the psycho-neuroses.

The French school, of which Babinski and Janet are notable modern exponents, constitute a kind of halfway house. Although they do not delve so deeply into the patient's past as do the Freudians for an explanation of the paralysis, anæsthesia, phobia, or whatever anomaly there may be, they do attach great importance to psychic factors. Babinski's theory that hysteria (called by him pithiatism) is caused by suggestion and can be cured by persuasion, has gained many adherents during and since the Great War; and treatment based on the principles enunciated by him has probably

effected at least as many cures as the more controversial—and to many frankly distasteful—and time-consuming method of Freudian psycho-analysis.

Some, notably Sherrington, believe the objective, motor, sensory, visceral, vasomotor, etc., anomalies to be primary; whilst the psychic changes are secondary and dependent on the former.

HYSTERIA.

Oppenheim [2] has stated that in hysteria the mental power is unimpaired, and that the condition is more often found in intelligent than in stupid people; Kennedy [3], on the other hand, has quoted military statistics to show that hysteria is relatively uncommon amongst officers, who may be assumed to form the "intelligentsia" of the Army. My experience, such as it is, supports Kennedy's figures, and I have not yet come across a case of pure hysteria in an officer. The Air Force figures also stress the rarity of hysteria amongst their officers, especially those engaged on full flying duties.

Most observers agree that the hysterical person is born, not made. He is an individual, above all, of marked emotional poverty, and, curiously enough, all the emotion he possesses is exteriorized in the form of emotional outbursts. Such emotion as a hysterical individual commands (or fails to command) is concentrated on himself, and he is "narcissistic" and ego-centric to a very marked degree. In our treatment of hysterical individuals it is therefore of primary importance to break down if possible this vicious circle of extreme ego-centricity and to endeavour to induce our patient to transfer his interest and affection to some object or individual other than himself.

Many writers have endeavoured to replace the somewhat archaic term hysteria (lit., air in the womb) by a more modern and descriptive label, viz., pithiatism (Babinski), psychogenia (Somner), but so far these laudable attempts have not met with success.

This is obviously not the place to attempt to catalogue the protean manifestations of hysteria, by far the commonest of which in the peace-time, post-war soldier are the hysterical fit and characteristic anæsthesia; very often the former may be followed by the latter and its true nature determined by it.

Hysterical anæsthesia is, in its typical form, of great diagnostic importance, especially in the differential diagnosis of hysterical from epileptic convulsive attacks; the timely testing for analgesic areas after a fit of doubtful ætiology may, as stated above, settle the diagnosis.

So convinced am I of the importance of testing for analgesia in suspected hysterical conditions that I once considered the propriety of writing an article on hysteria under the slogan "carry a pin."

I am aware that it is stated that true epileptic attacks may be followed by anæsthesia, but I doubt if this anæsthesia is ever of the true hysterical

type; if such were the case in a patient of mine under examination I would suspect a fit of mixed ætiology of the nature of hystero-epilepsy.

The only common organic nervous diseases that may be confounded with hysteria on account of the similarity of the type of anæsthesia are syringo-myelia and hæmato-myelia, in both of which dissociated anæsthesia of segmental type may occur.

Dissociated anæsthesia is not common in hysteria, but I have seen several examples amongst military patients.

Out of a small series of twenty cases of hysteria of which I have personal notes, ten had anæsthesia of varying degree. In nine the anæsthesia was of the segmental (amputation) type, commonly known as "stocking and glove" anæsthesia, whilst in one case, following shortly after a severe hysterical fit, complete unilateral analgesia was found which lasted only one day. In one case the anæsthesia was of the "glove" type, limited to one upper extremity, and followed shortly after a severe injury to one hand causing bony ankylosis of most of the carpal bones. The circumstances of this case are interesting and suggest "psychic trauma" as the cause of the anæsthesia. The man, a soldier, had deserted from the Army for "domestic" reasons and injured his hand while cranking up a lorry when employed as a lorry driver after desertion. Although the hand was exceedingly painful and greatly crippled him, he refrained from consulting a doctor for fear of being apprehended and returned to his military duties. Finally, he was forced to give himself up to escape starvation. In his case the anæsthesia was "dispersed" at one sitting, the permanent organic disability of the hand remaining, of course, unchanged.

In another case anæsthesia of the "stocking" or "sock" type was superadded to an organic paralysis of the anterior tibial group of muscles of one leg of doubtful ætiology; again the anæsthesia was removed by one application of the faradic brush, but the paralysis has persisted.

Similar cases of hysterical manifestations grafted on to organic lesions, examples of so-called "reflex hysteria," are of course well known, and should not, as Colonel Kennedy has pointed out, be officially diagnosed as hysteria in the presence of an underlying organic lesion.

One case of functional paraplegia was of quite exceptional interest. The patient, a young soldier, had suffered from a sore throat, during the course of which many throat swabs were negative to Klebs-Lœffler bacillus. Whilst on guard some weeks later he suddenly felt his legs give way under him and was brought into hospital with complete paraplegia, remaining paralysed and bedridden for six weeks, when he came under my observation as a case of post-diphtheritic paralysis. At this time both legs were in a condition of extreme *rigid* extension, and great difficulty was experienced in passively flexing the knees; both feet were strongly plantar flexed. There was at this time fair voluntary movement at the hips and slight movement at the knees but none at the ankles; knee- and ankle-jerks were brisk and both plantars were flexor—obviously at this stage *not* a case of post-diphtheritic

paralysis, which is essentially a *flaccid* paralysis with *absent* knee-jerks. Spinal trouble was suspected and a lumbar puncture was performed, the fluid being normal. Massage and passive movements of the legs were ordered, and I was much surprised to find, on my round the following morning, that the spasticity had entirely disappeared. A day later he was up and walking round the ward, and within a week had been returned to duty at his own request. I wrote to the medical officer previously in charge of the case who assured me that he considered the man to be a case of genuine post-diphtheritic paralysis on admission to his ward and that he had, in addition, suffered from palatal paralysis on first admission (there was, however, no history of regurgitation of fluids!). Be that as it may, the case was undoubtedly one of functional paraplegia when first seen by me. On perusing the patient's medical history sheet, it was interesting to note that there were several admissions for laryngitis (probably hysterical aphonia), the first attack of "laryngitis" having occurred suddenly while on the march to attend a parade. Whether the above was a case of functional paraplegia grafted on to a post-diphtheritic condition or pure hysteria from the start, I am not in a position to say; in spite of the medical officer's assurance, and with all respect to his professional acumen, I suspect the latter.

The cause of hysterical anæsthesia is, with the whole problem of hysteria, debatable ground. Some, Babinski prominent amongst them, attribute the condition wholly to suggestion, usually by the medical officer. In proof of their claim they quote Charcot's experiment (although curiously enough Charcot himself did not make this deduction) of transference of anæsthesia from one limb to another by the simple application of a magnet. Others, including many of our English neurologists, are not prepared to dogmatize. Oppenheim is unable to accept the view that "all these disturbances are artificial and produced by suggestion."

That hysterical patients do actually feel in the anæsthetic areas, although presumably not conscious of so doing, may be proved to anyone's satisfaction by the "yes, no" test.[1]

It is maintained by some (Tanzi [4]) that all the symptoms of hysteria, including hysterical anæsthesia, are psychical in origin, due to a highly delicate suggestibility, and that before they become reactions these marked phenomena are present as mental images. It is hard to believe this to be true in its entirety. A complete hemi-anæsthesia that is found accidentally on examination on the day following a hysterical seizure in a patient who

[1] In many cases of hysterical anæsthesia if the anæsthetic area be pricked with a pin alternatively with non-anæsthetic areas, the patient having first been blindfolded and directed to say "yes" when he feels the prick of the pin and "no" when he does not, he will frequently say "no" when the anæsthetic area is pricked, although he will deny feeling anything, thus showing that he must be in some way conscious of the fact of being pricked. The above test is usually only successful on first examination of the patient when he is taken unawares and rarely "works" on subsequent examinations.

is entirely unaware of the fact, can hardly have been produced previously as a mental image, unless we accept the Freudian doctrine that the condition is a "symbol" of some repressed wish or emotion.

Undoubtedly the peculiar psychical state is there. My impression is that the patient with his highly-coloured suggestibility misinterprets or grossly exaggerates a condition actually present, most probably due to some local vasomotor change in the affected area, a local vaso-neurosis.

It is to be noted that vasomotor phenomena, such as localized swellings of the limbs, blueness, etc., which are notoriously common in hysterical individuals, have much the same distribution as hysterical anæsthesia, usually with an abrupt upper limit; these phenomena are genuine, not "psychical fakes," for they are there for anyone to see, however transient and "psychical" in origin they may be; witness also the well-known phenomenon of dermographia, an actual demonstrable fact, in no way under the patient's control, conscious or otherwise, yet none the less a common hysterical manifestation and probably due to instability of the vasomotor apparatus. Is it not possible, nay likely, that hysterical anæsthesia belongs to the same order of phenomena, and, like them, whilst intimately connected with psychical processes and occurring in individuals of a peculiar mental and emotional make-up, is not in itself directly produced by suggestion? It may well be that disordered interplay of the endocrine system has more to say in their causation than we know of.

Tanzi [5] hints at the same idea when he states: "This functional plasticity, which extends to all the processes of innervation, has a wider range and significance than can be assigned to simple suggestibility. The suggestibility of hysterical patients is, therefore, an aspect or part (and a large part) of a more general fact, namely, the facility with which the nervous centres act to a certain extent out of all accord with the ordinary rules, inhibitions and proportions. Hysteria and suggestibility are not, however, the same thing, and it is a pure hypothesis that behind every hysterical phenomenon there must be the inspiration of some suggestion."

With these weighty words, retrograde though some may think them in view of much of the modern teaching, I am in complete accord.

Again, the same author writes, in reference to the vasomotor phenomena so constantly observed in hysterical subjects:—

"Some of the vasomotor disturbances are of a very remarkable nature. Hysterical patients are subject to subcutaneous ecchymoses, œdematous swellings and hæmorrhages, which are related to a diathesis. This vasomotor diathesis perhaps constitutes one of the foundations of hysteria, for to the congestive and asphyxial reactions that are visible must be added those that are invisible, to which, occurring within the viscera and the brain, may in all probability be attributed the co-anesthetic sufferings and emotional changes that afflict and characterize the lives of hysterical subjects. In other words, all the visceral riddles and psychological anomalies which by their extraordinary rapidity, superficiality, and definiteness are a

constant wonder to the laity, and which are not capable of being explained even by medical men who make a special study of hysteria, may perhaps have, as a mechanical substratum these vasomotor disturbances which suddenly appear in definite sites, and then vanish."

Again weighty words, well worthy of our careful consideration and attention.

No matter what theories we advance as to the actual exciting cause of the individual hysterical phenomena—the trigger that fires the gun—we must all admit to the pathological suggestibility and altered emotional tone of these patients.

In an interesting and instructive article dealing with the diagnosis and treatment of functional nervous disorder, T. A. Ross [6] states: "It might, indeed, be said that the mainstay of many practices consists of those patients who do not present physical signs. They are not confined to one class of society, they are scattered throughout all, and I suspect there are plenty of them in hospitals also, but they are not to be found much in the wards; they are probably seen by the junior out-patient physician, to whom they come again and again for the paper bearing the magic words 'Rep. Mist.'! The conscientious doctor with much industry examines them all over, to discover what it is that is producing these disabling symptoms; he passes in review their internal organs, their teeth, their eyes, their nasal sinuses, and what not; and so fine are the modern methods of diagnosis that some lesion, some departure from the normal ideal, can be found in most of them, if enough care is taken. Appropriate treatment is applied, and in the majority of instances great improvement takes place. After a period the patient has another illness without physical signs, again after examination and treatment improvement occurs, and this often goes on indefinitely. With some patients, however, the periods of improvement are short, later on do not occur at all, and much time and trouble are spent in trying to find out what is wrong, without avail. I am very far from saying that because a patient exhibits no physical signs he is to be regarded as suffering from a neurosis; no doubt focal infections make people ill; and, still more, there are certain diseases such as encephalitis, disseminated sclerosis, cardiac degenerations, etc., in which physical signs may be absent for a time; but what I want to emphasize is that the majority of patients who go in and out of illnesses over a long period, and who yet present no signs, are more likely to be suffering from a nervous than from a physical illness, and that in such the mental state should be investigated."

The danger outlined above, of "*over*" investigating the psychoneurotic patient is a very real one in our Army practice, and only serves in many cases to fix irrevocably the neurosis.

Especially does this tend to occur, I regret to say, in those stations, those Meccas of military medical practice, wherein specialists abound. Undoubtedly one can overdo the investigation side of the business, and I am afraid—I do not claim exemption—most specialists do, in their zeal,

overdo it. There are few amongst us with "pet hobby-horses" to ride who can refrain from riding them to death both in and out of season.

Again Dr. Ross writes: " . . . . There has been a tendency in some doctors to diagnose diseases that were not there, diseases sometimes which the doctor invented because he did not know what to say. In my younger days cardiac debility was one of them. He did not diagnose any known form of heart disease, for that could be contradicted; he said that at the time he was examining the patient there was a weakness, and later, if someone else should say there was nothing wrong with the heart, well, he never said that the thing was more than temporary. The doctor himself had acted narcissistically; he had got out of a difficulty by some means other than facing it, regardless of the fact that someone else would have greater difficulties to face. For this is true, that everything in this world which we ourselves shirk will have to be shouldered by someone else."

The ears of most of us must tingle—I must confess mine did—at the perusal of these pregnant words.

The evil consequences of a "slack" diagnosis in these cases are especially great in military practice, where a diagnosis once made and entered in the medical history sheet literally sticks to the individual for the remainder of his Army life.

Would that in many of these obscure cases one had the power to refrain from making a dogmatic diagnosis, only recording the signs and symptoms with such deductions as one could usefully make; trusting that on the occasion of a future admission or after further observation, possibly as an out-patient, the disease will diagnose itself, as so often happens.

N.Y.D. is not allowed as an official diagnosis, but some such non-committal label is required just as much for this difficult class of case as is P.U.O. in the sphere of the fevers. The day should have passed when inability to diagnose a case would be taken as a failure of professional acumen, an admission of incompetency, on the part of the doctor.

How many times has one glanced through the patient's past record of admissions on his medical history sheet to find many entries, sometimes covering several sheets, for various ailments the diagnosis of which bears excellent testimony to the medical officer's fertility of resource, but which fail to mention the disability—frequently a psychoneurosis—from which the patient really suffers. The medical officer has, in the words of Dr. Ross, behaved narcissistically, and has failed to come to real grips with the situation. All of us, of course, are guilty of this mild form of self-deception which is rendered almost inevitable by the official and "statistically minded" attitude which always demands a definite diagnosis—even for an indefinite complaint.

Many of the medical history sheets in these cases are most instructive, and may throw considerable light on the patient's complaint.

Colonel Kennedy, at the inter-Services meeting already referred to,

commented on the increase of hysteria in the Army of recent years. This is, I think, not to be wondered at when one compares the pre-war, beer-drinking, rather unimaginative "Tommy" with the post-war soldier—a far better educated, but also a more highly strung and emotional type, with very possibly a history of a starved and unhappy childhood during the hungry war days.

The following is an extreme example of the type :—

Pte. A. was admitted to hospital for sleeplessness and bad dreams, and volunteered the following history which I give almost in his words. All his life, so long as he could remember, he had suffered from a "phobia" of something, he knew not what, always pursuing him at night during his sleeping hours. Recently this phobia had become more insistent, and he had been frightened to sleep and had suffered from headaches on account of it. He also had other phobias, a fear of "unorganized" crowds; organized crowds such as troops on parade did not worry him. He also appeared to suffer from claustrophobia, and on this account was very uneasy on the transport coming out to India. He had "knocked" about the world a good deal and had read much, preferably "intellectual" books and those dealing with psychological subjects. After much questioning I discovered that he attributed many of his symptoms to an incident that occurred soon after enlistment. He was employed as a recruit on digging parade when a mate threw a worm at him ; he was *terrified* of worms, ever since he had been forced to eat one as a child, and turned white ; his comrades noticed this and from this time made a point of throwing all the worms they could find at him; which made these digging parades unendurable. He absented himself twice from the digging parade, and on the second occasion got drunk and went to find the N.C.O. who was responsible for detailing him for the parade in order to thrash him ; he was apprehended and placed in the guard room ; while there he struck the N.C.O. in charge and was court-martialled. A similar incident had occurred since his arrival in India. He feels that he must keep constantly "on the move," and gets into trouble if he remains in one station for any length of time. He was of healthy appearance and good physique. His Wassermann reaction was negative and there were no signs of organic nervous disease.

His story appears almost too good to be true, and I shrewdly suspect that much of it was inspired from his perusal of psychological literature, especially that part dealing with the more prurient details of psycho-analysis.

Nomenclature of Psychoneuroses.

In the inter-Services discussion on functional diseases, to which several references have already been made, Colonel Kennedy said : "I should like to see the diagnosis of hysteria strictly limited to cases of a pithiatic nature, conforming to the modern conception of hysteria, but it is difficult to do this until more latitude is given by our nomenclature. In the Army we strictly adhere to the Nomenclature of Diseases of the Royal College of

Physicians (last edition published in 1917). In this classification there is nothing intermediate between hysteria and psychasthenia, so that it is difficult to place the psychoneuroses such as anxiety neurosis, compulsion neurosis, and the obsessional neuroses. Hence some of the cases diagnosed 'hysteria' and included in my group 'D' (mental) would be more accurately described as anxiety neuroses. The three Services differ somewhat in their use or interpretation of the nomenclature, and a comparison of their views on this subject should be of interest, but, in any case, it will be agreed that our official nomenclature should be revised to meet modern requirements."

I understand that the Official Nomenclature is under revision, so we may in the near future be allowed a wider range in the choice of our diagnostic labels than that now accorded us.[1]

The Royal Air Force, apparently, are not limited by the Official Nomenclature, and have evolved a very satisfactory terminology based on clinical rather than psychological factors.

Their nomenclature includes the following groups :—

(*a*) *Hysteria.*—This term includes a wider range than the pithiatism described by Babinski, and now includes conversion and suggestion neuroses (reflex paralysis which appears to fall between the organic and functional is not included).

(*b*) *Neurasthenia.*—This category does not include simple "debility" which is used to designate conditions of actual physical weakness, often secondary to some toxic condition such as malaria, influenza, etc.

(*c*) *Anxiety Neurosis.*—This includes the condition of "nervousness."

(*d*) *Psychasthenia.*—Restricted to the group described by Janet. Includes the "manias"—doubting mania, washing mania, etc.—and the phobias.

(*e*) *Psychoneurosis.*—" Border-line " cases ; used as a convenient label for " N.Y.D. mental " cases.

(*f*) *Psychoses.*—Recognized mental diseases.

War Experiences.[2]

A very similar classification to the above was in use in the special neurological centres (N.Y.D.N. centres) in France during the war.

In these centres special wards were allotted for the following categories of cases : (1) Simple exhaustion ; (2) neurasthenia ; (3) hysteria ; (4) confusional states ; (5) miscellaneous mental states (psychoses, &c.).

As a result of experience gained in France it was soon evident that the medical officers in charge of the neurological units and engaged in the diagnosis and treatment of the extremely difficult class of case collected therein, required special qualities and experience, viz., the power of

[1] Since this paper was written, the sixth edition of "Nomenclature of Diseases" has been issued.

[2] Largely abstracted from the section on Neurasthenia and War Neuroses, "Medical History of the War," "Diseases of the War," vol. ii.

maintaining discipline amongst this unstable population, and a knowledge of neurology and psychology, as well as being conversant with the more successful methods of psycho-therapy—with the possible exception of psycho-analysis, which was generally agreed to be too laborious a proceedure for war-time treatment.

In war as in peace hysteria was noted to be uncommon amongst officers, whilst neurasthenia of the type of "nervous breakdown" was correspondingly common; the severest forms of psychasthenia being found amongst officer patients.

It was noted that during battle periods there was a rush of mild cases of psychoneurotic disorder to the neurological centres, of which only a small proportion were officers; whilst during the relatively quiet periods of trench warfare there were far fewer admissions, but they tended to be of a severe type with a high percentage of officer patients.

Two factors of overwhelming importance contributed to a high admission rate for the psychoneuroses; these were prolonged fighting and heavy bombardment; other factors were relatively negligible. When the above two factors operated together (i.e., during battle periods), the admission rate for this class of case reached its maximum.

The relative severity of the type of case admitted during the quiet periods as compared with the milder cases reporting during battle periods may, in part, be explained by the varying importance of the "seed" and the "soil" in the causation of the psychoneuroses.

Of the two, in determining the severity and eventual prognosis, the seed (i.e., inherent instability of character, &c.) is of grave importance; whilst those neuroses which are determined by agonizing and terrifying experiences under conditions of abnormal stress (the soil) in individuals of more or less normal mental make-up are much more amenable to treatment.

Major Webster [7], in an interesting article on the psychogenetic psychoses, has explained this point with great lucidity.

Some degree of hyperthyroidism was common amongst these patients. This is not to be wondered at when we consider the close connection of conditions of fright with exophthalmos and dilated pupils; hence the expressions, "his eyes dilated with terror," "eyes popping out of their sockets with fright."

Malingering, in its strict sense, was rare (this is also true, although often denied, of our peace-time Army). A mere exaggeration of symptoms, even if the deception be gross and intended to deceive, is not malingering, but rather springs from that craving for sympathy and display, inherent in most psychoneurotics.

Malingering is a "cold-blooded" deception by an individual of normal mentality, after due reasoning of the advantage to be gained thereby, and means far more than even "skrimshanking," which was so freely indulged in during the war.

The question of desertion, absence from duty, sleeping on guard, etc.

raised some very difficult problems during the war; and, in view of the severity of the punishment, entailing the death sentence in certain cases, every precaution had to be taken to ensure that the delinquent was not the victim of *petit mal* attacks, post-epileptic automatism, post-encephalitis lethargica, fugues, amnesic attacks, wandering mania, etc.

Two cases in my series illustrate these difficulties. The first occurred soon after the war during our occupation of the Rhine. The man, a soldier, was found sleeping on guard and was placed under arrest to await court martial. In the interval a letter was received from his family doctor stating that he had had an attack of epidemic encephalitis in 1924 (a vintage year) and since then had been subject to periodic attacks of pathological sleepiness.

The second example occurred recently on the North-West Frontier of India. The man was under observation in hospital at Razmak (Waziristan) for "fits" and strangeness of behaviour. After a period of observation he was discharged N.A.D.; and immediately, on leaving hospital, walked straight out into tribal territory, where he was found six miles away in a Mahsud village by a khassadar and brought back into camp. He had no recollection of his movements from the time he left hospital until he "came to" in the Mahsud village two days later, and fully realized the grave risk he was running in wandering in tribal territory unarmed. Presumedly a striking case of epileptic equivalent or post-epileptic automatism. The possibility of a hysterical amnesic attack is probably ruled out by the danger he ran in thus absenting himself.

There is no doubt that many of these post-epileptic and post-encephalitic phenomena, more especially the latter, closely mimicked hysteria and other neuroses, and have added considerably to our difficulties in the diagnosis of these conditions.

Can Psychoneurotics be Detected on First Enlistment?

In the selection of candidates for flying duties the Royal Air Force conduct a very searching examination under the following headings:—

(1) *Past History.*—With special reference to the incidence of previous nervous symptoms, i.e., breakdown at school, fits, convulsions, insomnia, nightmare, or sleep walking. A history of head injury or concussion is carefully investigated.

(2) *Family History.*—As to nervous or mental trouble, or shell shock.

(3) *Mental Make-up.*—Based upon the demeanour and behaviour whilst under examination; efficiency and interest in sports; education; occupation; consumption of alcohol and tobacco.

(4) *Physical Examination.*—This is very comprehensive. In addition to the ordinary examination for signs of organic disease, the following additional tests are carried out:—

The behaviour of the respiratory and cardio-vascular apparatus under stress is examined, by breath holding, and by sustaining a column of mercury 40 millimetres high for as long as possible, the pulse-rate being

recorded at five seconds intervals. The systolic and diastolic pressures are taken and exercise tolerance tests are carried out.

The nervous system is examined for organic disease, attention being paid to the deep reflexes ; any tremor of the fingers or eyelids is noted ; and the candidate is made to stand steadily on one foot for fifteen seconds with the eyes closed and to raise steadily a metal rod balanced on a wooden board. In special cases the Reid apparatus for testing co-ordination and reaction time is also employed.

Squadron-Leader Burton, to whose account of the above tests I am indebted, states: "Regarding the efficiency of tests for determining stability, it is significant that only a very small percentage of officers selected for flying duties break down even under conditions of severe strain while employed on such duties."

The very comprehensive scheme outlined above should bar the door to most psychoneurotics, and might well be adopted in a modified form, to meet their special requirements, by the Army recruiting authorities.

It is obvious from a casual glance at many of these neurotic patients who later break down under the stress of military service, that they would never last the course and should never have been enlisted. Unfortunately, there may have been no gross organic defect sufficient to justify their rejection on their first appearance before the recruiting medical officer, and they have been passed into the Army as satisfying the somewhat inelastic standard laid down in the "Instructions for the Physical Examination of Recruits" (A.M.S. Regs., Appendix 11B), often against the medical officer's better judgment. Many of these defectives could, it would be thought, be weeded out at the depots.

DISTINCTION BETWEEN MINOR CONCUSSION AND TRAUMATIC NEUROSES.

During the course of the inter-Services discussion on the neuroses mentioned above, the Air Force representative, Squadron-Leader Burton, stated that psychoneurotic symptoms may follow a head injury which has been so slight as almost to escape notice. Such cases, in which the injury may be followed immediately or after several weeks or months by headache, nervousness, defects of memory and of concentration, disturbed sleep, etc., are now diagnosed (in the R.A.F.) "Effects of Concussion" ; the symptoms being considered to be directly due to cerebral disturbance set up by the head injury, and therefore "commotional" rather than "emotional" in origin.

Dr. C. P. Symonds [8], who considers the symptoms detailed above to be due to minor concussion, is of opinion that the frequency of the so-called traumatic neuroses following head injury is a good deal exaggerated, and that the minor mental symptoms so often encountered are mainly due to organic damage. "They are," he says, "the mental symptoms of major contusion spread thin."

He also reiterates the truism that "the brain may be seriously damaged

without any fracture of the skull, without any objective physical signs, and occasionally in the absence of any history of concussion, and conversely, that a fractured skull is in itself no proof of cerebral damage."

The following example, which came under my observation, is instructive as showing the extensive damage that may accrue from an apparently trivial injury:—

A soldier "drifted" into a base hospital in France on account of increasing headache. He gave a history of walking along a trench some days previously, when a German aeroplane was passing overhead; he noticed a slight and sudden shock on the top of his head, as though he had been hit by a small piece of spent metal, but took no further notice until he was worried some days later by increasing headache. On routine X-ray examination of the skull, we were surprised to find a small perforation on the vertex of his skull from which a track led down through the brain tissue to a German bullet, which was lying vertically, with its tip impinging on the palate [9].

This and other examples exemplify the amount of brain damage that may accompany an apparently trivial injury to the skull.

It is a mistake, both from the point of view of treatment and fairness to the patient, to confound these cases of true concussion headache with the far more elusive traumatic neuroses from which many of them have only recently been separated. The differential diagnosis may be, for a time difficult, or even impossible, but it is always advisable to "play for safety," and to treat cases of doubtful ætiology with a period of rest, with possibly a course of salines to reduce any intracranial pressure that may be present. The former usually respond to this treatment; the latter are frequently made worse by it.

Headache.

Headache is a very common Army symptom, and it is often extremely difficult to distinguish the organic from the functional.

I am always somewhat sceptical when confronted with a patient with a very violent and obtrusive headache, which entails much groaning, turning and twisting in bed, and many sleepless nights, which are often, on further interrogation of the night Sister, found not to be so very sleepless after all.

Headaches of this nature are usually functional (cephalalgia). Headaches due to organic conditions, such as increased intracranial pressure, toxæmia, etc., are usually, luckily for the patient, accompanied by a drowsy or lethargic condition. If asked, the sufferer from an "organic" headache merely states the fact, and does not, as a rule, volunteer the statement that his headache is "driving him crazy," nor will he threaten to commit suicide, as may the hysterical patient.

I must confess, however, to have had under my care recently a notable exception to this generalization—a young officer, who suffered from a most agonizing, violent, and prolonged headache, caused by meningeal hæmorrhage, the result of either encephalitis or the rupture of a congenital aneurysm.

Apart from these hysterical headaches, headache is also met with as a common symptom in neurasthenia.[1]

A headache also usually follows the epileptic fit, often accompanied by drowsiness; both symptoms of some diagnostic importance, as hysterical patients often feel extremely bright and well after they have "let off steam" by means of a fit.

Migraine is, in my experience, in its classical form, an uncommon Army complaint. I have seen one recent example in an overworked surgical specialist, in which the usual phenomena of hemicrania, teichopsia, etc., were replaced on one occasion by internal ophthalmoplegia of one eye, with a fixed dilated pupil, an example of so-called ophthalmoplegic migraine.

The exact position of migraine in the neuroses is uncertain; some consider the condition to be a pure psychoneurosis; others claim that it is closely allied to epilepsy, and quote examples in which epileptic attacks may at times be replaced by "migrainous equivalents." These cases are rare, and the habitual sufferer from migraine does not, as a rule, conform in any particular to the epileptic type.

Many attach importance to toxic conditions of the alimentary tract; and many sufferers from migraine will agree that an attack may be warded off by a timely dose of calomel. An attack of migraine may follow a few days' constipation.

Oppenheim favours the theory of a vasomotor neurosis as the essential cause.

Tanzi states that migraine and epilepsy are usually classed with the neuroses, and superficially have much in common. Both are characterized by paroxysms which tend to occur periodically; both usually start in early life; in both there is often a history of family predisposition of a neuropathic nature; both are often ushered in by an aura (teichopsia in the case of migraine); in both an accumulative effect may be observed, i.e., an unusually long peroid of freedom may be followed by an unusually severe attack. Rarely, migraine is later replaced by epilepsy, and vice versa. Tanzi admits, however, that the resemblance is only superficial; a history of epilepsy in a migrainous family is unusual, and the slow march of the migrainous aura suggests a different ætiology to that of epilepsy.

Some have postulated a theory that migrainous and other severe headaches may be due in certain cases to increased intracranial pressure produced by the temporary blocking of the foramen of Munro, possibly secondary to some anatomical peculiarity.

The above are only hypotheses, however, and the fact remains that headache is common, migraine uncommon, in the Army.

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[1] An excellent description of the neurasthenic headache is given by Reynolds—see under Neurasthenia.

(To be continued.)

THREE CASES OF "TROPICAL TYPHUS" OCCURRING IN BANGALORE, INDIA.

By Major J. BIGGAM,
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Introduction.

During recent years, a group of typhus-like fevers occurring both in tropical and in temperate climates has attracted widespread attention. The members of the group, though differing in certain points, bear a strong resemblance to each other and all of them seem to be closely related to typhus exanthematicus.

The following is a short summary of some of the important contributions to the subject of these fevers.

McNaught [1] in 1908 described "Two cases of paratyphoid fever" which occurred at Wynberg, South Africa, in 1907. He stated that they were "clinically distinct from enteric fever, being more like small-pox or typhus." Several cases of a similar type had previously occurred at the same station.

In 1911 the same author [2] described three groups of an anomalous fever common in South Africa, which at that time he regarded, though very doubtfully, as an aberrant type of paratyphoid fever. The first of these groups was that already mentioned as occurring in Wynberg in 1907; the second, a group of ten cases at Pretoria in 1909; and the third a group of twenty cases at Roberts' Height in 1910, all clinically of the same type, and closely resembling the "tick typhus of India" as described by Megaw [3] and other writers.

McNaught stated that "It resembles typhus in its onset and duration," and again that he "has no doubt that it is a distinct entity and can be differentiated clinically from enteric fever or the recognized forms of paratyphoid fever." He makes no mention of tick bites or similar sores on his patients, nor of lymphangitis or adenitis, but he states that he was informed by Lieutenant-Colonel Maher that a precisely similar fever was common at Potchefstroom and this officer suggested that ticks might have conveyed the infection, as the patients had been bitten by ticks two or three days before the onset of the symptoms. While writing this paper McNaught read an article by Brill in the *American Journal of Medical Sciences* for April, 1910, describing "an acute infectious disease of unknown origin," and McNaught considered this fever identical with the one that he was describing. By May, 1911, he had decided that the disease he had been reporting was "not enteric fever, paratyphoid, or Mediterranean fever."

Brill apparently first considered that the disease described by him (Brill's disease) belonged to the paratyphoid group, an opinion he afterwards abandoned. Later it was regarded as mild typhus exanthematicus (endemic typhus of America). Before he died Brill considered that his disease was not typhus. It must probably be included in the large group of typhus-like fevers, the exact causation of which is still undecided.

Two well-recognized types of a typhus-like disease conveyed by arthropod vectors—spotted fever of the Rocky Mountains, a disease conveyed from rodents to man by the tick *Dermacentor venustus*, and Japanese river fever (Kedani disease), conveyed by a mite vector—have been known for fifty years. They are both closely related to typhus exanthematicus and to the sporadic typhus-like diseases caused by an unknown vector, now being extensively studied all over the world. Their geographical distribution, however, has been found to be much more extensive than their names would suggest.

In the *Indian Medical Gazette* of January, 1917, J. W. D. Megaw described a typhus-like fever from which he himself suffered the previous year, in which the vector was probably a tick.

In 1925 Megaw, Shettle and Roy [4] reported a series of typhus-like fevers which occurred in Saugor in Central India. A further series was reported, and the existing knowledge of these fevers was summarized by Megaw and Rao [5] in June, 1928. Still further cases have since been reported from India.

Typhus-like fevers had also been reported from Australia [6], Malaya [7, 8], Kenya [9, 10], America [11], Tunis, in and near Marseilles and the Mediterranean coast [12], and Rome [13]. Anigstein has recently conducted an important investigation into the typhus-like fevers of Malaya [24].

A "tick-bite fever" of Lourenço Marques was described by Sant' Anna [14] (the name was proposed by Nuttall), and a similar type of fever occurring in Southern Africa by Nuttall [15], and recently by Troup and Pijper [16]. The latter observers consider the disease described by them to be identical with that described by Sant' Anna and Nuttall, and agree with these writers that the vector is a larval tick. This fever appears to be of a different clinical type to the fever described by Megaw and others, although probably belonging to the same group of typhus-like diseases. The lesion following the tick-bite and the regional lymphangitis and adenitis in the former contrast with the absence of these signs in the latter type. In the very mild form of South African "tick-bite fever" also there may be no rash. The primary sore in this "tick-bite fever" is similar to that described by Schuffner [17] in the pseudo-typhus of Deli in Sumatra, the latter disease being carried by a mite vector. Primary lesions (bites or ulcers) have also been noted in the Marseilles, Tunis and Kenya cases.

The ætiology of South African "tick-bite fever" is discussed by Pijper and Dau [18], who, from brain examinations of guinea-pigs inoculated intraperitoneally with fresh blood from fever patients, consider the disease to be caused by a rickettsia. Further experiments on the transmissibility

of the virus to guinea-pigs [19] confirm their views. This would bring South African tick-bite fever into line with typhus and Rocky Mountain spotted fever, two other human diseases in which rickettsia have been demonstrated as being present.

A Note on Rickettsia Bodies.

These were first found by Ricketts in Rocky Mountain fever in 1909, and identified by Ricketts and Wilder in typhus cases in 1910. They have also been found to be present in trench fever and in "heartwater," a South African cattle disease. All louse, or tick, transmitted diseases. As stated above, Pijper and Dau consider South African tick-bite fever to be caused by a rickettsia, and recent work (reviewed in the *Tropical Diseases Bulletin* of January, 1932) indicates that rickettsia have been demonstrated in cases of endemic typhus (Brill's disease) and in Japanese river fever.

Rickettsia bodies are small formations, the exact nature of which has aroused much controversy and is as yet unknown. Many workers have questioned the statement that rickettsiæ are living micro-organisms, and at different times they have been considered to be mitochondria, cell granules, the granular products of digested blood, non-specific granules, etc. There are many non-pathogenic rickettsiæ, these bodies being exceedingly common inhabitants of the arthropod group; normal insects which have not been exposed to infection from vertebrate hosts have been found to harbour them.

Only four types are at present recognized by the majority of workers as pathogenic, these being the rickettsiæ found in Rocky Mountain spotted fever, typhus, trench fever, and "heartwater" disease of cattle.

The pathogenic forms are exceedingly pleomorphic, Gram-negative, bacteria-like formations, in size from about 0·3 to 0·5 by 0·3 μ or a little larger, and occurring in coccal, bacteria-like and filamentary forms. Their presence in large numbers is constant in the infective arthropod, but in the human host is less obvious.

In typhus fever, rickettsiæ have been found in the human host, mainly in the vascular endothelial cells throughout the body, and in the endothelial cells in the spots of the skin rash, and these bodies appear to be indistinguishable from the rickettsia seen in the epithelial cells lining the gut of the infected louse. Lice do not as a rule become infective until a latent period of about seven days has elapsed after the infecting meal. Some workers consider that the infection is conveyed by the excreta of the louse reaching a cut or abrasion which allows the virus to enter the body; some that the infection is conveyed by the louse bite.

In trench fever, a louse-borne disease of the Great War, the mode of transmission of the disease closely resembles that of typhus. Clean lice, fed on trench fever patients, develop rickettsia bodies, but lice fed on healthy, uninfected individuals do not.

In Rocky Mountain spotted fever the tick shows a widespread infec-

tion in the gut, salivary glands, reproductive organs, brain and muscles. Rickettsiæ are also present in the ova of infected ticks and may infect the next tick generation. In the human tissues the rickettsiæ are found in the endothelial cells and muscle cells of damaged blood-vessels.

Spencer and Maxcy [20] have noted that although typhus and Rocky Mountain fever are clinically similar in human beings, they are immunologically distinct. Neither virus affords any measurable degree of protection to recovered animals against a subsequent inoculation of the other. The ætiological agents, therefore, of the two diseases are biologically distinct, even if closely related.

Serology.—Serologically, the typhus-like group of fevers has been studied and discussed by many observers, including Spencer and Maxcy [20], Pijper and Dau [23], Felix and Rhodes [21], and Felix [22].

Typhus exanthematicus agglutinates live suspensions of *Bacillus proteus*, X 19 of Weil and Felix.

Many strains of *Bacillus proteus* have been used for the differentiation of the various typhus-like diseases. The resulting evidence is conflicting. For example, all the cases of Fletcher and Lesslar in Malaya gave positive Weil-Felix reactions, but two epidemiologically distinct groups of tropical typhus were found in the Malay States, one group agglutinating the Kingsbury, or non-indol-producing strain of *Bacillus proteus*, X 19, and the other the indol-producing strains such as the Warsaw strain. They note that repeated tests should be made after the temperature has come down in the third or fourth week.

In the Mediterranean type of fever, the Weil-Felix reactions were originally usually negative, but various observers have noted that although the test may be negative during the febrile period, it is very often positive after the temperature has become normal.

Pijper and Dau [18] found that in South African tick-bite fever in a few cases only was a positive Weil-Felix reaction obtained, but they afterwards discovered that the best results were obtained during convalescence, and not while the patient had fever.

Troup and Pijper [16] note that South African tick-bite fever agglutinates the *proteus* strains X 19, X 2, and X Kingsbury. They also note that the titre evidently rises as the disease progresses and reaches its highest value many days after the patient is quite better.

In the majority of the Indian tick-typhus group the Weil-Felix reaction was negative.

Spencer and Maxcy [20] investigated the Weil-Felix reaction in forty cases of Rocky Mountain fever in various stages of the disease. A positive Weil-Felix reaction undoubtedly occurred in most of the cases late in the disease or in convalescence.

Thus, great variations have been noted in the Weil-Felix reaction in the various types of the typhus group of diseases, but with improved methods of investigation order will probably be evolved from the apparent

confusion which has existed in the past, and the methods of differentiation of the various types should become clear.

Although the varieties of the typhus-like diseases may differ ætiologically, serologically, or epidemiologically, they closely resemble each other clinically in :—

(*a*) A high temperature, lasting about two weeks and falling by lysis.

(*b*) A maculopapular eruption, sometimes containing petechial elements.

(*c*) A typhoid state of varying intensity.

As regards the epidemiology of the disease the following points have been noted :—

(1) The maximum seasonal incidence is during the hot weather.

(2) There is no evidence of louse transmission.

(3) It is a disease of any class, not specially of the poor and uncleanly.

(4) Its sporadic occurrence and uneven distribution.

(5) A lack of evidence of a direct communicability from an infected person.

Megaw [3] has classified the typhus-like diseases according to their vectors into four groups :—

I. Louse typhus (typhus fever or typhus exanthematicus).

II. Tick typhus (Rocky Mountain fever).

III. Mite typhus (Japanese river fever).

IV. Typhus of unknown or uncertain vector.

It is in the fourth class that such fevers as "tropical typhus," Brill's disease, pseudo-typhus of Kenya, spotted fever of Tunis, typhus-like fever of Marseilles, etc., must as yet be placed.

The name "typhus of unknown vector," as the writer says, "will probably receive a happy burial when we know more about the fevers of the typhus group." He believes that most of these doubtful fevers belong to the tick-typhus category.

Notes on Three Cases of Typhus-like Fever which occurred in Bangalore, India.

The three cases of a typhus-like disease of which case notes and charts are given here occurred in the British Garrison in Bangalore in 1931. There is no evidence as to the type of vector responsible, so that at present they fall into Class IV of Megaw's classification.

Pte. L., aged 21, 6th Armoured Car Company, Royal Tank Corps.

Clinical History.—Last admitted to hospital with Flexner dysentery in January, 1930. No illness since. Has not recently been to camp, but has attended several single-day manœuvres with his unit within the last month. These took place seven to ten miles south of Bangalore. He did not at any time notice ticks on his body, and no lesions corresponding to bites of any kind were noticed on admission.

January 17, 1931 : Malaise ; cold and shivery by day, hot during the night.

January 18: Fairly well till 10 a.m., then tired, feverish and suffering from frontal headache. No muscular or joint pains. Lay on his bed all day.

January 19: Reported sick from morning parade as he felt too ill to carry on. Temperature 102° F., pulse 108, headache and backache. Admitted to hospital.

January 20: Frontal headache, cold and shivery, severe aches and pains all over the body, especially in the back. "Can't get comfortable anyhow in bed." Slight but definite faint red (ham coloured) macular rash, first noticed on chest and abdomen. Evening temperature 105° F., pulse 110.

January 22: Headache and body aches and pains continue. The rash has now spread over the whole body from face to toes. Relatively few spots on face, but except for this it is an abundant, evenly distributed, discrete, palpable, dull red, papular rash, largely fading on pressure. Average diameter of spots three millimetres. Rash gives rise to no discomfort.

Abdomen rather tumid. No enlargement of liver or spleen. Constipation marked. Tongue coated with thick brown fur. Complains of slight sore throat and difficulty in swallowing, but examination reveals no abnormality. Conjunctivæ slightly congested. No jaundice. Superficial glands not enlarged. No respiratory signs or symptoms. Appetite poor. He is uncomfortable and sleeps badly at night owing to the muscular and joint pains, but he does not look really ill or even apathetic, and remains alert and cheerful. This was a striking feature of the case throughout the illness.

January 29: Condition almost unchanged. The rash has deepened to a dull red or coppery colour, is petechial in type, and definitely palpable. It covers the body evenly and now includes the palms of the hands and the arches of the soles of the feet. There are relatively few spots on the face and none on the scalp. The rash gives rise to no discomfort and there are no palpable superficial glands.

The evening headache continues, but the joint and body pains have almost disappeared. The appetite remains poor, and obstinate constipation only relieved by enemata persists. The patient states that he is not normally constipated. The tongue is clearing. The pulse has been relatively slow throughout the disease.

February 4: The temperature, which has been falling steadily for six days, touched normal this morning. The rash is beginning to fade, but is still very marked. Patient has a good appetite, clean tongue and feels quite well.

Convalescence was uneventful. Staining at the site of the rash was still quite visible ten days after the temperature had reached normal.

Précis of Symptoms.—Fever: Sixteen days fever from the date of admission, the temperature reaching 105° F. early in the disease, then remittent from about 102° to 100° for ten days and falling by lysis to normal on the eighteenth day from the onset.

Pulse: Relatively slow throughout the disease.

Rash: First noticed on the fourth day from the onset. At first macular, then papular. Palms of the hands and soles of the feet involved. Petechial on the thirteenth day. Began to fade on the nineteenth day, staining being visible ten days after temperature had reached normal.

General Symptoms.—Headache from onset. Severe body aches and pains from the third till the eleventh day, most marked early in the disease, suggested the diagnosis of dengue fever.

AGGLUTINATION TESTS.

	26.1.31	29.1.31	3.2.31
B. typhosus	7 S.A.U.	18 S.A.U.	*Nil*
B. para "A" ..	68 S.A.U.	64 S.A.U.	—
B. para "B" ..	52 S.A.U.	46 S.A.U.	—
B. para "C" ..	—	—	—
B. proteus X-19—			
Kingsbury ..	—	*Nil*	*Nil*
Warsaw ..	—	*Nil*	*Nil*
Multesar ..	—	*Nil*	*Nil*

TOTAL AND DIFFERENTIAL LEUCOCYTE COUNTS.

	22.1.31	30.1.31	2.2.31
Total	6,600		
Polymorphs	68 per cent		
Lymphocytes	22 ,,	Results very similar to those of 22.1.31	
Mononuclears	7 ,,		
Eosinophiles	3 ,,		
Basophiles	—		

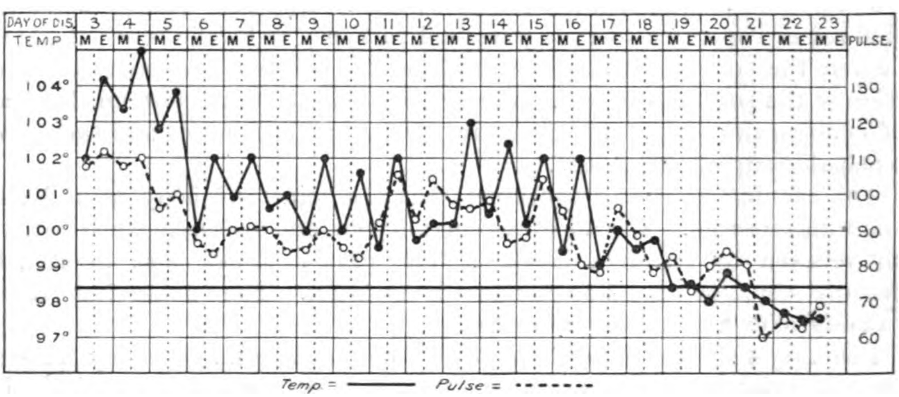

CHART I.—Private L.

Private L. was inoculated with T.A.B. on August 26, 1929, and the second time on September 6, 1929. Blood cultures taken on January 26 and 30, 1931, were sterile. Fæces and urine were examined for enteric group of organisms daily from January 30 to February 6, 1931. The results were negative.

Serjeant F., aged 30, Royal Artillery.

Clinical History.—No history of previous illness. He contracted the disease while at camp where he had been for the previous three weeks. This camp is seventeen miles north of Bangalore, sited on uncultivated land covered with sparse scrub. It is two miles from the nearest village and 3,000 feet above sea level. The patient had at no time noticed ticks on his body, nor were any skin lesions noticed on admission to hospital.

October 13, 1931 : First noticed vague aching pains in both wrists.

October 16 : Thought he had sprained his wrists as the ache continued and gradually got worse. Felt feverish later in the day when the aching pains had spread to legs and ankles and he developed a frontal headache. No appetite.

October 17 : Carried out duties in camp, but felt feverish and now ached all over the body. Vomited once, very thirsty, but ate nothing all day. Bowels normal.

October 18 : Reported sick to me and was diagnosed dengue. Temperature 103·5° F., pulse 90. Acute muscular and joint pains all over body, especially in the arms and legs. Severe frontal headache. Slight but definite discrete macular rash on wrists and chest. Remainder of body not examined. Evacuated to hospital.

October 19 : Restless and sleeps badly. Pronounced frontal headache. Furred tongue. Bowels regular. Severe aching all over body, especially in the legs. Extensive and abundant, discrete, small, dull red papular spots all over the body, except on the palms of the hands and soles of the feet. Relatively few on the face. These are of an average diameter of three millimetres. They give rise to no discomfort and fade only slightly on pressure. The conjunctivæ are only slightly injected. There is no sore throat and the mucous membrane of the mouth is normal. No spleen or liver enlargement. Superficial glands not enlarged. No jaundice. Pulse is relatively slow (it remained so throughout the disease). There are no chest or abdominal symptoms.

October 24 : General condition unaltered. Rash gradually deepened in colour to a dull-purplish red and became petechial in character. At this stage it invaded the palms of the hands and the arches of the soles of the feet. The scalp remained free and there were few spots on the face, but otherwise the whole body was covered with a profuse, discrete, papular rash. The headache and body pains diminished in intensity and were easily controlled by aspirin, phenacetin and caffein, which gave a fair night's rest. The appetite remained poor throughout.

October 31 : Headache and pains in body have almost disappeared. Rash is beginning to lose its angry look and fade except on the hands and feet. Patient feels definitely better.

November 4 : Temperature touched normal; all pains and headache gone. Patient sleeps and eats well. Rash fading rapidly, leaving behind a dull brown staining. (This was still perceptible fourteen days after the temperature had reached normal.) Convalescence was uneventful.

It was noticeable that although the patient ran a fairly high temperature for nineteen days, he never looked or felt really ill. After the acute discomforts of his early aches and pains diminished he was fairly bright and cheerful, and spent a good deal of his time reading.

AGGLUTINATION TESTS.

		22.10.31	27.10.31	4.11.31
B. typhosus	..	*Nil*	125 S.A.U.	125 S.A.U.
B. para "A"	..	*Nil*	54 S.A.U.	61 S.A.U.
B. para "B"	..	91 S.A.U.	205 S.A.U.	205 S.A.U.
B. proteus X-19—				
Kingsbury	..	*Nil*	1/125	1/50
Warsaw	..	*Nil*	*Nil*	*Nil*
Multonar	..	*Nil*	1/25	1/50

TOTAL AND DIFFERENTIAL LEUCOCYTE COUNTS.

		26.10.31	20.10.31	6.11.31
Total ..	..	12,000	7,000	Very similar results
Polymorphs	..	63·6 per cent	62·0 per cent	
Mononucleare	..	4·6 „	7·0 „	
Lymphocytes	..	31·6 „	32·0 „	
Eosinophiles	..	—	—	
Basophiles	..	0·2 „	1·0 „	

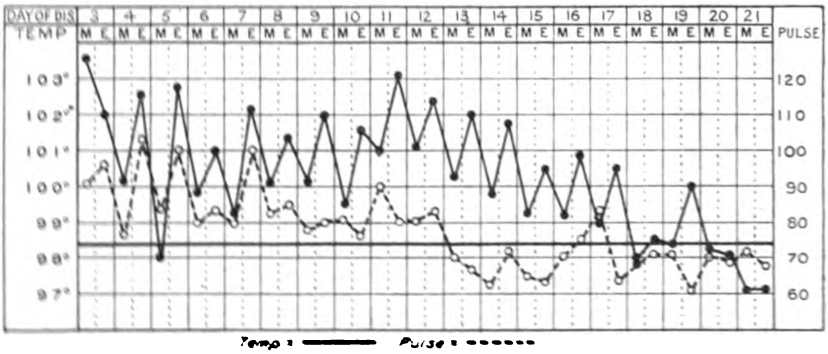

CHART II.—Serjeant F.

Précis of Symptoms.—He had seventeen days fever from date of admission to hospital, reaching 103·5° F. on day of admission, then remittent for fourteen days and falling by lysis to normal on nineteenth day from onset. Pulse was markedly slow throughout the disease, especially during the latter half. Rash was noticed on the third day, at first macular then papular, petechial on the ninth day, when it had invaded the palms of the hands and soles of the feet. Began to fade on the sixteenth day. Staining at site of rash still visible fourteen days after temperature reached normal.

Headache and severe aches and pains all over the body continued from the day of onset till the twelfth day.

Serjeant F. was inoculated with T.A.B. on April 25, and the second time on May 5, 1931. Blood culture made on October 22, 1931, and was sterile.

Private J., aged 25, Royal Tank Corps.

Clinical History.—He has had no illness since he came to India four years ago. On November 25, 1931, he returned with his unit from a twelve days tour by road of about 800 miles through scrub and heavy jungle country from Bangalore to Belgaum, camping with his company each night by the way.

From the day of his return until the beginning of his illness ten days later, he was never outside Bangalore. He had never noticed a tick on his body, and no skin lesions were noticed on admission to hospital.

December 8, 1931 : A little headache. Patient "took a powder" and thought no more of it.

December 9 : Woke up with occipital headache radiating down the back of the neck and general malaise. Ate no solid food all day as he had no appetite. Felt cold and shivery in the afternoon, and cold, restless and sleepless during the night.

December 10 : In the morning felt cold and shivery, giddy and weak. Severe occipital headache and pains across the eyes. No aches in the body. No vomiting or abdominal discomfort. He had no appetite, and when he sat up on his bed at 4 p.m. to drink some tea he fainted. Company medical orderly was called, found his temperature to be 104° F., and sent him to hospital. He was restless, and could not sleep during the night. During the night aches and pains in the body began. Every joint in his body "felt stiff," and he ached all over, even in his finger-joints. "Could not find a comfortable position" in bed. Severe bursting headache.

December 11 : Aches and pains all over the body and severe headache continued. Feels chilly, shivery and ill. The rash was first noticed this morning, discrete spots on forehead, chest and arms, which give no discomfort.

December 12 : Rash has now spread all over the body, especially profuse on the face, neck, arms and legs, less marked on the chest and back. It is a florid papular rash, dull red in colour, consisting of palpable discrete spots 2 to 5 millimetres in diameter, ¼ to 1 inch apart, fading completely on pressure. Appetite very poor; sleeps fitfully at night. Feels weak and ill. No constipation or jaundice. No conjunctival injection. Complains of slight sore throat, but little to be seen except slight reddening of fauces. Tongue coated with dirty brown fur. Neither spleen nor liver is palpable. No chest symptoms. No palpable glands.

December 15 : To-day headache and aches in body very much easier, and patient looks and feels much better. The rash, however, is even more marked and has now invaded the arches of the soles of the feet and the ulnar side of the palms of the hands. The scalp is free. Otherwise the rash covers the body completely and fairly evenly, being

least profuse on the chest, abdomen and back, and most marked on the legs. A very few spots are petechial, but the majority still fade completely on pressure.

December 17: Patient comfortable. No return of headache or body aches. States he feels weak but looks well and cheerful, and spends a good deal of his time reading, though the temperature remains up and the rash

AGGLUTINATION TESTS.

	14.11.31	17.11.31	24.12.31	31.12.31
B. typhosus ..	80 S.A.U.	312 S.A.U.	141 S.A.U.	125 S.A.U.
B. para "A" ..	62 S.A.U.	108 S.A.U.	108 S.A.U.	108 S.A.U.
B. para "B" ..	181 S.A.U.	400 S.A.U.	450 S.A.U.	182 S.A.U.
B. proteus X-19—				
Kingsbury ..	*Nil*	1/250	1/50	*Nil*
Warsaw ..	*Nil*	1/250	*Nil*	*Nil*
Multesar ..	*Nil*	1/250	*Nil*	*Nil*

TOTAL AND DIFFERENTIAL LEUCOCYTE COUNTS.

	17.12.31	24.12.31	1.1.32
Total	6,400	6,700	6,200
Polymorphs ..	42 per cent	38 per cent	58 per cent
Lymphocytes ..	48·5 ,,	55 ,,	35·3 ,,
Mononuclears ..	7·5 ,,	5 ,,	5·7 ,,
Eosinophiles ..	0·5 ,,	2 ,,	0·3 ,,
Basophiles ..	1·5 ,,	—	0·7 ,,

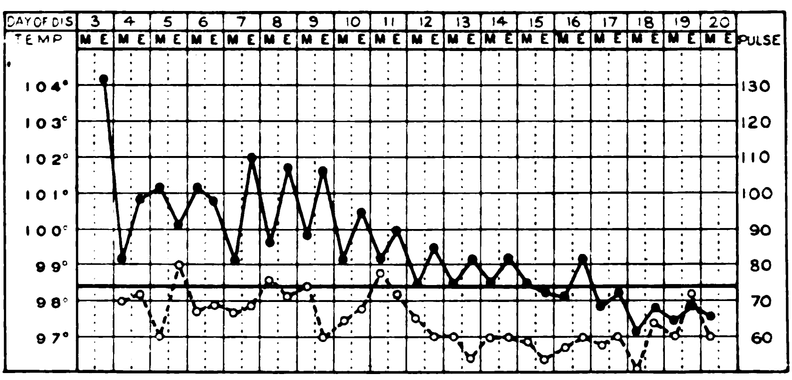

CHART III.—Pte. J.

shows no alteration, except that it is darkening in colour. He still sleeps badly, but the appetite, though poor, is improving and the tongue is clearing at the sides. The pulse remains, as it has been from the beginning, relatively slow.

December 19: Feels very well. Appetite good. The rash, which is now very largely petechial in character, shows definite signs of beginning to fade on the face, arms and body, but remains unaltered on the legs.

December 21: Tongue clean all over. He feels, sleeps and eats well. Rash continues to fade but is still very marked on legs and feet.

December 23: Feels perfectly well. Rash has almost disappeared from body and face. Still visible on side of neck, ulnar side of arms and quite definite on legs and feet.

December 24: Temperature normal all day for the first time.

December 30: Patient perfectly well. Spots just perceptible on ulnar side of arms and quite distinct on legs and feet.

January 5, 1932: Discharged from hospital feeling normal. Legs still show definite staining at the site of the rash.

Précis of Symptoms.—Fever: Sixteen days' fever from date of admission to hospital. Temperature 104° F. on admission on third day of disease, thereafter remittent until it fell by slow lysis to normal on the eighteenth day from the onset. Never over 102° F. after the day of admission. Pulse was rarely over 72 throughout the disease. Rash was noted on the third day, at first macular, then papular, largely petechial on the twelfth day, when it began to fade. Staining still definitely visible on the thirteenth day after the temperature had become normal.

He had headache from onset and severe body aches and pains from third till eighth day.

Pte. J. was inoculated with T.A.B. in March, 1931. Blood culture made on December 13 and December 17, 1931, was sterile.

General Notes on the Cases.

The three cases under review presented rather varying features.

(1) In all three repeated blood films showed no malaria parasites. Total and differential blood-counts were not particularly enlightening, there being no definite leucocytosis or leucopenia. In one case, however, there was a definite relative lymphocytosis. Serologically it was found in the two later cases that there was a definite rise in the agglutinins for *B. typhosus*, para A, and para B, as noted by other observers.

As regards the Weil-Felix reaction, this was negative in the first case. Three tests were done, the last on the eighteenth day of the disease. In the case of F, the first test was negative (seventh day); on the twelfth day agglutinins were present for Kingsbury (1/125) and Multesar (1/25), on the twentieth day the titre had sunk for Kingsbury to 1/50. In the case of J, the Weil-Felix reaction was negative on the seventh day; on the tenth day agglutinin titre for Kingsbury, Warsaw, and Multesar was 1/250, but on the seventeenth day, save for Kingsbury (1/50), the reaction was negative, and completely negative on the 24th day.

These findings are at variance with previous observations, in which the tendency was for this reaction to be positive after the fever had subsided and convalescence had been established.

(2) The rise in titre for *B. typhosus*, para A and para B, in the cases of F and J. might suggest the possibility of these being cases of enterica. Apart from the sterile blood-cultures, they were clinically entirely unlike fevers of the typhoid group. The acute type of onset with dengue-like pains, the time of appearance and character of the rash, the absence of even abdominal uneasiness, the feeling of well-being as soon as the muscular and joint pains had ceased, and the rapid convalescence presented a clinical picture quite unlike typhoid or paratyphoid fever.

(3) As in two (L. and F.) of the three cases the infection was likely to have been acquired in, or within a radius of twenty miles of, Bangalore, it might be of interest to mention that during the season, November to March inclusive, several medical officers have been regularly shooting over areas of scrub and uncultivated land within a radius of forty miles from Bangalore. None of them, however, has at any time either seen ticks or suffered from their bites, nor have they on return from shooting suffered from any skin lesion or irritation which would have suggested an arthropod bite acquired in this open country.

Conclusion.

It is evident that these typhus-like fevers in India are of more importance and probably much more common than was at first realized. Comparatively few cases, so far, have been reported from southern and western India, but several cases have recently been reported from the Deccan and Poona areas [25], and the three cases now reported occurred in a comparatively small British garrison within one year.

The diagnosis, once suspicion of the nature of the disease is aroused, is easy; but to one unaccustomed to dealing with the typhus group of fevers the cases may be puzzling.

I am indebted to Major C. Scales, M.C., R.A.M.C., for suggesting the diagnosis of the first case and for all laboratory work; and to Lieutenant-Colonel J. W. L. Scott, D.S.O., R.A.M.C., for permission to forward the cases for publication.

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CEREBROSPINAL MENINGITIS: THE BEARING OF ATMOSPHERIC HUMIDITY ON OUTBREAKS, WITH REMARKS ON PROPHYLAXIS.[1]

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Ex-Captain (Temp.) R.A.M.C.

Mr. President and Gentlemen,—The work concerning which you have invited me to address you to-night belongs mainly to the past, to the period of the war. Its recall, then, constitutes for me an occasion for reflection upon the inexorable march of time and the shortness of the years during which we exercise our activity.

Sixteen years ago, working as a military bacteriologist in England, I had the good fortune to observe a certain connection between atmospheric humidity and the occurrence of isolated cases of cerebrospinal meningitis. This observation led me ultimately to advance a cosmic hypothesis connecting outbreaks of the disease with a high degree of atmospheric humidity, particularly indoor humidity in sleeping quarters. To give you a brief account of the main facts on which I based this hypothesis, and to indicate certain practical conclusions concerning prophylaxis which I drew therefrom, is the object of this address.

I was led to investigate the connection between weather conditions and the occurrence of cases of the disease in consequence of a Memorandum issued by the War Office, London, in the summer of 1915, to all its bacteriologists, calling for reports on their work. In this was mentioned certain points on which information was desired, among which was the influence of general weather conditions. The only profitable way to reply to such a question was to plot graphs of the meteorological conditions for a given place and to study thereon the distribution of cases. I selected Weymouth in Dorset, which happened to be the laboratory headquarters at the time. Graphs were made of the sunshine, of the rainfall, of temperature, of humidity for the period March to June, 1915, and the cases which had occurred over the period were marked thereon. To my astonishment, two of the curves showed a distinct correspondence between their maximum and minimum points and the occurrence of cases. These were the humidity curve and a curve showing the difference between the maximum and minimum temperatures expressed as a ratio of the maximum temperature [1].

Fig. 1 shows the outdoor humidity curve at 9 a.m., with the cases

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[1] An address delivered before the *Société de Médecine et d'Hygiène Tropicales d'Egypte*, Alexandria, June 5, 1931.

bacteriologically positive for the period. Cerebrospinal fever is fortunately a disease which lends itself well to this type of investigation, because the onset is as a rule so sudden and so well defined that it can be fixed almost to a question of hours.

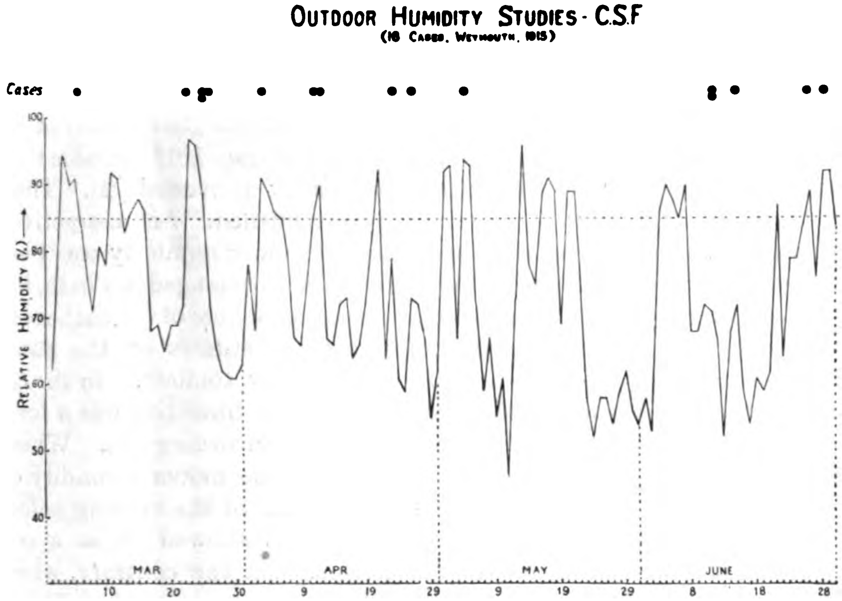

FIG. 1—Distribution on an out-of-doors percentage relative humidity chart of 16 cases of cerebrospinal meningitis at Weymouth, England, 1915.

A glance at this figure reveals a remarkable coincidence, namely, whenever the curve passes in a general way through a maximum value, the occurrence of a case of cerebrospinal meningitis is almost invariably an attendant phenomenon. If this is no mere coincidence, it indicates that any sudden increase in the degree of saturation of the atmosphere by water vapour is an ætiological factor of importance.

For the period in question, the agreement is so striking that could such a curve have been consulted beforehand it would have been possible to predict, almost to a day, the dates when cases of the disease should make their appearance.

For the maximum situated about March 23 to 24, when the relative humidity was the highest recorded, there were four cases. One of these cases, " G," is of particular interest. He arrived at hospital as a suspected case on March 24, with the history of a sore throat on March 22. Assuming that the throat condition was due to the meningococcus, the question arises whether he would still have developed the disease had the sudden degree of saturation of the air with water-vapour which occurred between March 22 and 23 not taken place. When I put that question to myself

some sixteen years ago I could not answer it, but in the light of the considerations which I hope to put before you presently I think there can be little hesitation to-day in answering it definitely by "probably not."

This more or less constant appearance of cases synchronous with a high degree of atmospheric humidity appeared to me too frequent to be a mere chance coincidence. Hence the tentative conclusion was reached that the saturation of the air with water-vapour was a predisposing factor in connexion with outbreaks of the disease when the microbe was about.

The careful study of sixty-two further cases in the Dorset district during the following year, between July, 1915, and June, 1916, enabled me to confirm and complete the conclusions previously arrived at [2]. Thus the hypothesis of 1915 became more solidly established. An instructive case in this series, emphasizing the importance of indoor humidity, was Case 10. This man developed the disease suddenly after a prolonged hot bath, having dallied for over an hour in the vapour-laden atmosphere of the bath-room [3].

Pursuing the question further, I undertook studies of the humidity indoors during sleeping hours in huts occupied by soldiers. In the course of these studies it became evident that the indoor humidity was a function of want of ventilation and of the degree of overcrowding [4]. When the ventilation was bad, or the overcrowding great, the indoor humidity of the morning (at reveille) was always higher than that of the evening before (at "lights out"), which on graphic representation showed up as a *marked* displacement between the respective curves. On the contrary, when the ventilation was good the morning indoor humidity curve was found to follow very closely that of the evening before, so that the displacement between the curves was usually *slight*, and at times the morning curve even ran at a lower level than that of the evening before. The outdoor readings at 9 a.m. figure here as control curves. In the top and middle diagrams of fig. 2, which brings out well the above points, the control outdoor curve is the same for both.

Fig. 2, then, illustrates very lucidly by its three series of triple curves what occurs indoors as regards humidity in occupied quarters during sleeping hours. The top diagram relates to a room in which the ventilation was *good* and where there was no overcrowding, there being approximately 800 cubic feet of air-space per person.[1] The middle diagram relates to an army hut of dimensions 45 by 20 by 9½ cubic feet, occupied by 14 men, allowing therefore 610 cubic feet of air-space per person; hence no overcrowding. But the morning indoor humidity curve, running at times at a comparatively high level, shows clearly the ventilation to have been *defective*. The bottom diagram relates to a hut in which two cases of the disease had occurred. Its dimensions were 60 by 20 by 9½ cubic feet, and it was occupied by 30 men, giving an air-space per man of approximately

[1] A Royal Commission of 1861 laid down 600 cubic feet as a normal allowance of air-space per person for military communities, etc.

380 cubic feet; hence *overcrowding.* The extremely high level of the morning indoor curve shows plainly that when these readings were taken the hut in question was not sufficiently aerated to prevent the almost

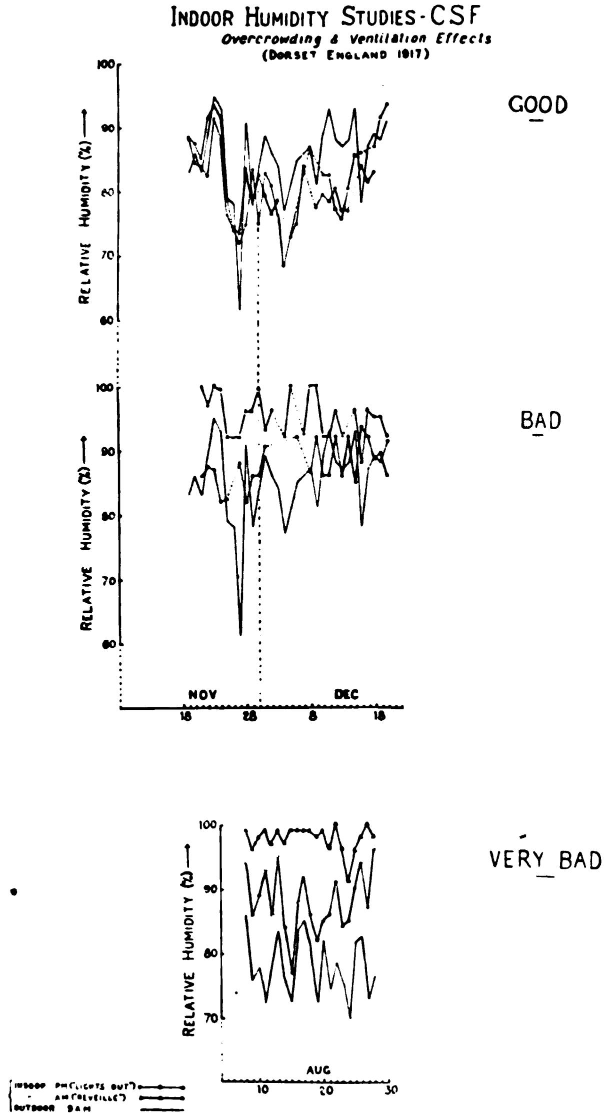

FIG. 2.—Giving a graphic representation of percentage relative humidity in three neighbouring quarters, the upper two for the same period.

complete saturation every night of its atmosphere by the water-vapour exhaled and transpired by its occupants during sleeping hours.

These studies establish, then, that in the conditions of overcrowding, and

especially of want of ventilation, which characterized the new life in the training camps of civilians who had become soldiers, such conditions of humidity existed indoors as to account for the appearance of cases of meningitis among any carriers present.

A question arose. How did an increase of atmospheric humidity cause the

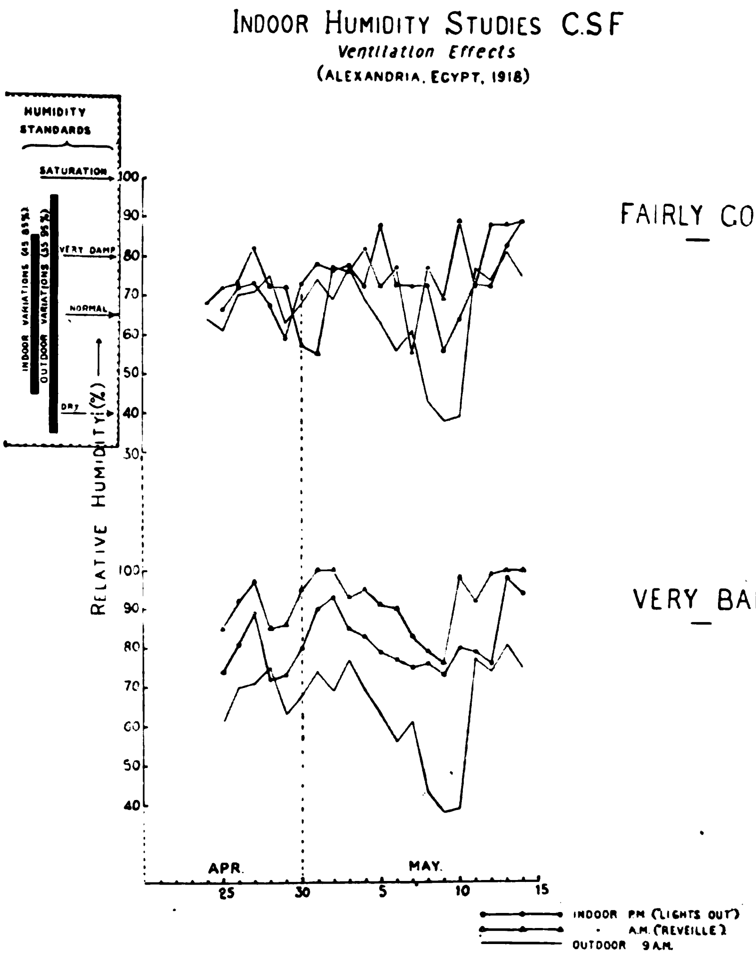

FIG. 3.—Giving a graphic representation of percentage relative humidity in two neighbouring quarters, for the same period.

meningococcus to travel from the nasopharynx of the carrier to the meninges of a susceptible to produce a case of meningitis? I regarded the matter thus. Under the influence of damp air—particularly the warm, non-renovated air that is breathed in overcrowded rooms and huts—the naso-pharyngeal mucosa underwent an alteration of a physical nature which rendered it more spongy and possibly more permeable, thereby permitting the meningococcus of the "carrier" to traverse the epithelial barrier and enter the

system, to quickly reach the meninges (a question of hours) and create rapidly the symptoms of meningitis [3]. Support of this viewpoint was found in some observations of Sir Leonard Hill [5]. He observed that when the nasal mucosa of individuals breathing the air of overcrowded, badly ventilated, overheated rooms, was examined with a speculum, it was swollen, œdematous, pitted when touched with a probe, and was covered with a thick secretion; while that of subjects examined out of doors on a fine day appeared pale, taut, showed no pitting, and the secretion was absent.

Thus we get an insight into how general weather conditions, in which raised atmospheric humidity features, act in the production of cases of cerebrospinal meningitis. High outdoor humidity means high indoor humidity, and as such acts in the same direction as the two indoor factors of overcrowding and defective ventilation. Outdoor humidity, viewed from this standpoint, obviously takes on less significance, becoming simply a useful, relative indicator of humidity indoors.

Here is another study (fig. 3) which established the same kind of result. It relates to Egypt. We have here comparative observations of the indoor humidity in two military tents, one situated at Mex Camp, Alexandria, the other at Ras-el-Tin (No. 21 General Hospital), both occupied during the investigation by the same number of soldiers, 5 in each case. The tent at Mex was pointed out to me as one in which 3 or 4 cases of cerebrospinal meningitis had originated in a small outbreak of 10 military cases in that camp during February to March, 1918. The hygrometric readings were made a few weeks later, during April and May, 1918. In regard to the tent at Ras-el-Tin (control experiment), instructions were given to the occupants to keep it as well ventilated as possible by sleeping with the flaps of the tent wide open at night, while no such instructions were issued to the occupants of the Mex tent.

A glance at these curves is sufficient to explain the occurrence of the cases in the tent at Mex. The curve of indoor humidity in the morning at "reveille" (lower diagram, fig. 3) is seen to run at a much higher level than the "lights out" indoor curve of the evening before. The former throughout the greater part of its course attains the level of almost complete saturation. Compared with the two indoor curves of the well-ventilated tent at Ras-el-Tin (upper diagram, fig. 3), both the indoor curves of the Mex tent are markedly higher, and the explanation is the inferior ventilation of the Mex tent.

Turning now to the recent epidemic of the spring of this year (1931) at Alexandria, let us see how the cases arrange themselves in the light of the foregoing series of facts. Fig. 4 provides the answer. The curve of outdoor humidity for the four months January to April is here portrayed, together with forty-three cases which occurred over the period. During the first two months the curve is seen to run comparatively low, its level being generally inferior to seventy-five per cent saturation, with the exception of

two brief rises above this level in January and one in the last week of February. On the other hand, from the end of February the curve begins to take on an upward tendency, and to run generally at a sustained higher level during March and April, there being many peaks situated above the seventy-five per cent line. Synchronous with this rising of outdoor humidity from the end of February onwards, there is a definite explosion of cases of the disease during March and April, as compared with the sporadic occurrence of cases during January and February. This figure is certainly very suggestive in its portrayal of the influence of high outdoor humidity in determining outbreaks when the microbe is about.

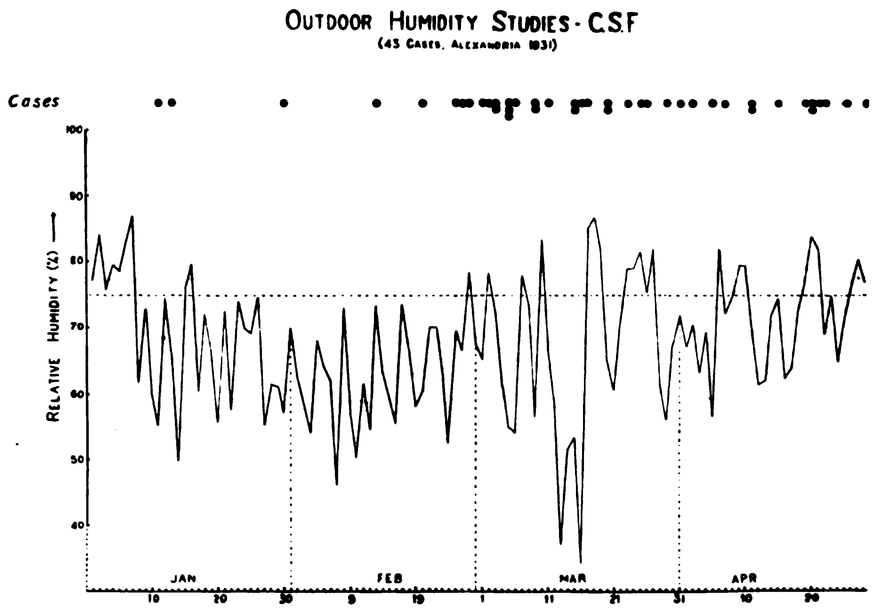

FIG. 4.—Distribution on an out-of-doors percentage relative humidity chart of 43 cases of cerebrospinal meningitis at Alexandria, Egypt, 1931.

In view of my previous remarks concerning the importance of indoor humidity there is no need to interpret other than in a general way these outdoor readings. Great as may be their face value they are of still greater conjectural value in the insight which they give concerning the conditions indoors in the dwellings of those who contracted the disease. I look upon these outdoor readings in their presumptive bearing on indoor humidity in much the same light that one considers *Bacillus coli* as evidence of pollution organisms, when judging of the purity or otherwise of a water-supply for drinking purposes. High outdoor humidity affords strong presumptive evidence of high indoor humidity. It was not possible to obtain readings of indoor humidity for any of the homes where cases originated in the recent outbreak, but if such readings were available there could be

little doubt that they would portray curves analogous to those of the military populations investigated in 1917 to 1918 (see bottom diagrams of figs. 2 and 3). The majority of cases occurred among the poorer classes. In the conditions of overcrowding and bad ventilation prevailing, indoor humidity must certainly have often reached saturation point.

To sum up, cerebrospinal meningitis appears to me to be a weather-disease, fostered by damp, muggy, humid, outdoor conditions of climate, with as a consequence excessive indoor humidity. But these conditions cannot of themselves produce the disease without the presence of the microbe. Cases of the disease signify the concurrence of two factors: first, the existence of "carriers" of the meningococcus; second, high atmospheric humidity, particularly high humidity indoors in the homes of the people or where they work. Excessive indoor humidity results from high outdoor humidity, from bad ventilation and from overcrowding. The simplest way ordinarily to combat excessive indoor humidity is good *ventilation*. The temperature indoors being usually higher than that out-of-doors, it follows that when the colder outdoor air (even though saturated) penetrates indoors, through efficient ventilation, it loses much of its saturation. It becomes then less conducive to naso-pharyngeal œdema, and so diminishes the risk of the meningococcus of the "carrier" migrating to the meninges to produce a "case."

Considerable attention has been called by the work of Glover [7] to the direct control of overcrowding by interspacing beds in military barracks. Interspacing is certainly ideal, but in civil life it is not always practicable, especially among the very poor. It represents after all only a particular aspect of prophylaxis, since it comes to the same thing as keeping the indoor humidity low. That attention to keeping indoor humidity low (good ventilation) is more important than the mere combating of over-crowding (distance between beds) is emphasized by the definite "case" reported as occurring within a short interval of dallying about for an hour in the steam-laden, muggy atmosphere of a bathroom [3]. When a choice then has to be made between housing conditions in which good interspacing of beds is possible but ventilation poor, against interspacing being impossible but ventilation good, it is preferable to select the latter; because it permits of better control of indoor humidity, which as we have seen is the factor of "paramount importance" in prophylaxis rather than, as stated by Glover [8], the distance between beds.

Confirmation of this view is afforded by the comparative freedom of the sea-going squadrons of the British Navy from the disease during the five war-years (1914-1919). Dudley [9] points out that in spite of the densest overcrowding below decks there was an almost complete absence of atmospheric moisture, as a result of the perfected system of ventilation adopted. Only sixty-four cases of cerebrospinal meningitis were recorded in the Fleet during the five years in question as compared with a thirty times greater incidence in naval boys' training establishments ashore.

In the selection of sites for military camps, schools and buildings for the housing of large numbers of individuals, it is advisable to avoid damp, low-lying regions, particularly in the neighbourhood of many trees, as the latter tend towards excessive atmospheric humidity. In times of an epidemic it is necessary to avoid overcrowding as far as possible; to prohibit the drying of wet clothes in sleeping quarters; and to stress good ventilation of sleeping appartments, in order to combat excessive indoor humidity which facilitates both the production of carriers and the occurrence of cases.

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BATOUM.

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I was talking to a man in the Corps the other day about war experiences and said something about an incident that had happened during our occupation of Batoum. "Good Lord," said he, "were we ever in occupation of Batoum?" Further chat revealed that he really had not known that we had sat there for over a year during 1919-20.

When we were there we fondly imagined the eyes of the world were focussed, intermittently at any rate, on the charming and interesting spot where we were trying to uphold British prestige; but after all it was not, apparently, a place of general interest. It was interesting, all the same, and I can't help thinking that some rambling impressions of the place and our medical doings there might be worth putting on paper.

After the Bulgarian débâcle, the Salonican Army permeated the near East from its old base, Salonica. Bits of it voyaged up through Bulgaria to Rouschouk on the Danube and Varna on the Black Sea. The major portion, including the Army Headquarters, went up to Constantinople, and from there pushed out a force to Asia Minor and a Division across the Black Sea to the Caucasus. The Division landed in Batoum, and from there filtered through Tiflis to Baku.

Towards the end of 1919, Tiflis and Baku were handed over to the Georgian Republic, and Batoum was left with our Brigade to look after it. It was then we felt that there might be a thrill or two left in the old war yet. We had some uncomfortable neighbours. Up north the White Army didn't look to be in very good shape as a fighting proposition to stave off the Bolsheviks from having a crack at our northern frontier; down south there were rumours of Enver Pasha's newly raised Turkish troops, who were said to be casting envious eyes on Batoum, and to the east of us was the recently created Georgian Republic, which obviously thought that the possession of Batoum would nicely round off their little bit of the earth's surface. That left us only one safe-looking side, the west, where we had the Black Sea with Constantinople only two days' sail away.

The Brigade remained in Batoum on its own for six months and that is the period of its history to which this sketch refers.

Batoum Province was the official title for the portion of the Caucasus we then occupied. It consisted of Batoum town and an area of country very roughly twenty miles round it in a half circle.

A beautiful subtropical place it is. As you approach it from the sea the town seems to project out on a spit of land with the ground rising rapidly behind to ranges of green-clad hills, with the snow-covered

Caucasus mountains gleaming at you away up north. As you come in closer the most noticeable feature of the town, the church domes, strike an Eastern note, while the oil tanks on the north side give you an idea as to the importance of the port. The pipe line from the oil wells at Baku treks across the breadth of the Caucasus to pour out its power-giving stream into the tanks at Batoum.

The harbour is fairly commodious. The town is a little smelly perhaps, but the streets are good in the better parts and out to the south, where the town beach is the main attraction; there are also shady avenues and well-laid-out promenades. But your eyes will be more on the people than on the town lay-out, which is typically representative of the Near East. They are a polyglot crew. At one end of the scale a magnificent Georgian, with grey, tight-waisted long coat, fur kaftan, Russian boots, with pistols and daggers *ad lib.* At the other a mean-looking Armenian clad in dirty white baggy garments who reminds you of a N.W.F.P. frontiersman bereft of his turban and fallen on very evil days. Between these extremes the populace ring the changes on all types of European and semi-European garb and facies.

Out into the country towards the casualty clearing station there are flowers and foliage in abundance all along the roads and round the houses. They strike an eastern note, as one would expect from the rather hot-house atmosphere of this midsummer day. Mimosa is just over, but camellias, azaleas and roses make the rather ramshackle houses look Arcadian. Palms, little and big, crop up here and there. The old quai-hais on landing in winter immediately got busy with their mosquito nets against the forthcoming summer. Their instinct was a true one.

Close above are the hills. On every peak is a little fort and each fort is joined up by a road to the next. These are the land side, Russian built, defences of Batoum and they make a strong natural position. Towards the end of the war Batoum was garrisoned by a force of 6,000 Georgians when an army of 10,000 Turks was reported to be advancing from the south. A strong position to be taken by so small a force, one would think. But the Georgians thought otherwise and disaffection arose amongst the men at the mere thought of an active defence. Trained orators were imported from Tiflis to speak winged words to the men and to check a rising tide of desertions. But the trains to Tiflis were easily boarded and the Turks came daily nearer. The defending force gradually dwindled till the orators could find only some few officers to talk to, so they all used that seductive Tiflis train and left the town open to a dysentery-ridden Turkish force who just managed to totter in. These same Turks were there when we arrived in 1919. The hospital we took over from them took a mighty lot of cleaning, but that same cleansing revealed it to be a hospital of the semi-temporary hutted type. As we approached it up a tree-girt road nothing military or medical met the eye till we emerged from the trees and saw a long line of dark brown, verandahed huts stretching away up the floor of a charming

valley, with steep tree-clad sides merging into high green hills in the near distance. The hospital had been built by the Russian Red Cross during the war and once we had unearthed it from the prevailing squalor we found most of the amenities of a decent hospital. A reasonable operating theatre delighted the heart of the surgeon, the sisters and officers had comfortable quarters, the C.O. had his office and the Quartermaster his store. A band of German and Austrian prisoners came along and made us an excellent dirt tennis court, leaving it complete down to greenery and trellis work embellishments reminiscent of a German beer garden. So we really had a pleasant environment for our bit of post-war soldiering. I did not arrive at Batoum until some months after the fight against dirt had resulted in this revelation of a hospital worthy of its charming situation.

The Commandant of the Brigade was also Military Governor of Batoum Province, and ran the whole of the civil administration as well as the military side. He allocated officers of his Brigade to act at the heads of all the civil departments of the provincial administration, including one to be in charge of the Tsar's tea garden, which was equipped with British machinery and produced excellent tea. The medical side fell to me under what high sounding title I can't remember. The main part of the civil side consisted of endeavouring to evolve plans to combat probable epidemics of typhus and cholera amongst the civil population. This danger was a very real one with a swarming refugee camp and an overcrowded city with only elementary sanitation. Fortunately I had a hard-working fellow Scotsman with me who took on the onerous job of city medical officer of health. He developed a flow of Russian and this combined with a persuasive but, at the same time, forceful manner accomplished wonders. Steam disinfectors were made to work, the refugee camp ceased to pervade the neighbourhood with distressful odours, and the night soil carts circulated to places where they really were required.

With his help the anti-epidemic plans did take some definite shape. They were evolved at a series of meetings with prominent local doctors. These Russian gentlemen, bearded, reverend seniors, were only too pleased to discuss health matters, but their side of the discussion was apt to be verbose and generally amounted to a series of statements to show the utter impossibility of doing anything practicable with the paucity of material and money at our disposal. We did evolve a plan' of campaign, but I was very truly thankful that no emergency of any magnitude ever arrived to put it to the test.

The Batoum hospitals had to be looked to and I found them very up-to-date in many ways, but a callous disregard for the comfort of the poorer patients and a mingling of the most stringent asepsis with the exact opposite, reminded one that Eastern ideas and usages were not very far away.

Anti-malaria work was a task that had to be faced and dealt with in the spring. The troops were housed in two areas, one on the north side

of the town and one on the south. The north area was partly hillside and partly flat plain where the main streams meandered down to the beach. The hillside was the most troublesome as it was well wooded and had a dense undergrowth through which flowed innumerable little streams. These had a nasty habit of forming small marshes on the flatter portions of their journey downwards. An English battalion occupied this upper ground and the medical officer inspired his soldier team to canalize and herring-bone this potential source of danger into comparative innocuousness.

The south area presented a different problem. An Indian unit was in barracks there on a flat plain which was separated from the sea by a large tract of rough grass-grown common bordered with large, deep brackish pools towards the sea. Between these pools and the sea the beach had humped itself into a formidable barrier against drainage to the sea. For a time we fondly imagined that anopheles would not breed in the brackish water; but we were soon disillusioned and the problem of dealing with them had to be faced. Expense vetoed drainage to the sea and we were left with the alternative of clean cutting the edges and paraffining the pools weekly. Paris green was not then known to us and the paraffining worked very fairly well.

As events turned out all our strenuous endeavours were wasted, for we left before the malaria season really got going, and any possible subsequent diminution of the mosquito population was, I fear, entirely unhonoured and unsung by the local Caucasians.

In fact, you will see that in the spring of 1920 we seemed to be settling down to make Batoum a reasonably safe place for prolonged habitation by H.M. Forces. Nine or ten officers, including myself, had banked on their future peaceful residence there to such an extent as to induce their wives to come out. A very pleasant place they found it to be, too. There was perfectly gorgeous bathing from sandy beaches that stretched for miles up to the north, there was polo on a decent grass ground to watch, tennis on two good courts and a certain amount of motoring in cars of ancient lineage and doubtful reliability. I was told the only blot on the landscape was the servant question, but as that is always with us, Batoum cannot be classed as unique in that respect.

In May the peaceful tenor of our existence was rudely disturbed by the news of the advances of forces from the north and south mentioned in a previous paragraph. Ships began to collect in the harbour, and whether we were going to fight or fly became the main topic of conversation amongst the troops and in the homesteads. A Georgian brigade was held up by an Indian platoon or two at a border town, but there was nothing much to stop the Bolsheviks on the north. Obviously Batoum might at any moment become a hot corner, and it did not surprise us when all the ladies were ordered to embark in twenty-four hours' time on to the hospital ship waiting in the harbour. That meant that all the married officers had to pack

up everything and embark their heavy luggage with their lady wives. Twenty-four hours of hectic endeavour, however, found all the ladies safely installed on the ship complete with their household goods.

The General Officer Commanding-in-Chief had meanwhile arrived with reassuring news which embraced all threatening quarters. The Bolsheviks were not going to invade Georgian territory, the Georgians had thought better of an offensive on Batoum and the Turkish force under Enver had ceased to be a threat. This meant that life could be resumed as before and the ladies fairly shot off the boat. Everybody was pleased except my Armenian orderlies who had the doubtful pleasure of humping back our boxes, and some of them were no mean weight, up 200 feet of steep hill path to our little bungalow which was perched on the hills above the hospital.

The respite thus gained did not last long, however. In mid-June we heard that Batoum was going to be handed over to the Georgian Republic and that every man, woman and child and every bit of equipment was to be embarked by a certain date. This meant real hard work for all hands. Everything had to be checked and counter-checked and then packed up strongly enough to stand a short sea voyage. Patients were coming in up till nearly the last moment and, owing to demobilization, there was not available a single non-commissioned officer of more than a few months standing. Everyone buckled to and a strict programme of events for the embarkation was adhered to, with not much more than an hour or so out either way. The vagaries of the transport were a continual menace to our timekeeping, but the R.A.S.C. kept it going somehow. When my ex-private serjeant-major came up and saluted to me on board at 6 p.m. on the last evening and reported that all personnel and kit were accounted for, a shake of the hand very faintly expressed my appreciation and, I think, he fully deserved those pints of beer with which, rumour hath it, he indulged himself that night.

Next morning was the last official day of our occupation and the handing over ceremony was due to take place in the central square of Batoum. On our way to the square we saw the Georgian army marching in. First came the infantry in reddish brown khaki; there was no attempt at a Guards effect. They did march in fours, but rifles were held any old way and dressing of the ranks was noticeable for its non-existence. A general air of toughness was given by the fact that the morning shave had been forgotten for the last few days, but when you had withdrawn your gaze from this unprepossessing feature, you quickly realized that toughness could not be an asset of such a weedy-looking crowd.

Cavalry followed two by two on horses of sorts. These looked as if they had been hurriedly collected from the fields and hadn't had their long coats groomed since they were put out to grass the previous autumn. Their equipment was on a par, but I suppose shining steel must have been considered as a sin against the dicta of the art of camouflage.

The guns looked wicked enough, but even there no attempt had been made to cheer them up with a bit of spit and polish.

The man I was with had been in North Russia. He said it reminded him of Bolshevik troops he had seen up there.

We walked on to the centre of the town, where we found the infantry brigade lining three sides of the square, while the Georgian infantry was busy forming up on the fourth. The infantry brigade consisted of two Punjabi regiments and one British. After a lot of presenting arms, and some talk which we could not hear, the final scene was staged. This consisted of the playing of the National Anthem, after which the Union Jack was hauled down from a tall flagpole and the Georgian flag was hauled up to the accompaniment of what presumably was the Georgian National Anthem.

A depressing scene it was, and I am not surprised that the Indian infantry could not understand why the Union Jack should be pulled down without even a shot fired.

Back we went to our ship, and in an hour or so we were sailing out from dear old Batoum past the serried ranks of a large proportion of the Mediterranean Fleet, not without regrets at leaving a place where Nature, at any rate, had done her best to make the place a paradise.

SOME MEDICAL PROBLEMS OF MUSTARD GAS POISONING.[1]

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In the European War the introduction of weapons which distributed asphyxiating, poisonous, or other gases, and analogous liquids and materials, added to the heavy responsibility which the Medical Services already carried, and presented them, and the research laboratories which served them, with new and intricate problems. In the later stages of the war the development of chemical warfare necessitated the creation of a special organization, from which the Chemical Defence Research Department has evolved. All the early anti-gas work was done under the ægis of the Army Medical Department, and much of it in this College. The names of Colonel Sir William Horrocks and Colonel P. S. Lelean stand out as those of pioneers in the organization of anti-gas research.

Before the German gas attacks in April, 1915, little was known outside the laboratory of the pathological action of many of the substances used in chemical weapons. It is therefore not remarkable that there was, at first, some confusion of thought as to the manner in which lesions were produced, and that lines of treatment should have been followed which, on a clearer understanding, were dropped.

The lack of knowledge of the action of chemical warfare materials, and the terror which they inspired, created a false impression of their deadliness, which was fostered by propaganda. However, a study of the invalidity figures of this and other countries, particularly those in the last volume of the Official Medical History of the War, makes it clear that against a disciplined force properly equipped with anti-gas appliances, and trained to use them, chemical weapons caused no more destruction than other weapons of war. Nor is there anything to show that the suffering they caused was greater than that inflicted by other weapons.

Research carried out during and since the war has enabled us to classify these poison gases according to their physiological action. The methods of studying them have been standardized, and it is now possible rapidly to assess the potency of a particular substance and the type of lesion it will produce. Incidentally, this work has given, and is giving, considerable help in the problems of protection of workers in hazardous industries.

We now divide warfare gases into three broad classes: (1) Tear gases, or lachrymators; (2) lung irritants, including the true lung irritants, e.g., chlorine and phosgene, and the irritant smokes which are mostly solid organic arsenical compounds; (3) the vesicants.

Much has been said regarding more deadly gases which may be used in future

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[1] Paper read on February 8, 1932, at a meeting of the United Services Section of the Royal Society of Medicine, held at the Royal Army Medical College, by the courtesy of the Commandant. We regret to record the death of Major Galwey which occurred while this paper was passing through the press. Reprinted by kind permission.

wars, but although over a thousand compounds have been examined in this and other countries, so far as I am aware no substance has been found which is of a wholly greater order of potency than those already used. It is, however, clear that the known warfare gases could be used more effectively than they were in the European War.

I shall chiefly consider the vesicant—mustard gas—the most potent of all the chemical weapons as a producer of casualties. However, our respirators now give complete protection against any concentration of the warfare gases likely to be met with in the field. Amongst other nations also, respirator research has developed greatly, and it is thought that most nations now have adequate protection in this respect.

Like all other chemical warfare agents, mustard gas was discovered in the course of ordinary research long before the war. Its chemical name is dichlorodiethyl sulphide. In its pure state it is a clear, colourless and somewhat oily fluid, with only a faint odour. It boils at 217° C. (412° F.), and becomes a white crystalline solid at 14·4° C. (58° F.). It is heavier than water, it vapourizes slowly at ordinary temperatures, and so tends to persist on the surface on which it falls.

Since pure mustard gas freezes at a relatively high temperature, it is used in chemical weapons mixed with a suitable solvent. As generally used it is a dark heavy liquid, which leaves a stain, and whose odour is more pronounced than that of the pure compound. It freezes at about 7° C. (44° F.).

Mustard gas has certain outstanding features which must be remembered:—

(1) *Stability.*—It is not easily broken down into harmless compounds by substances ordinarily available in the field.

(2) *Solubility.*—Whether as vapour or as liquid, it is readily soluble in many oils, such as fuel oils and greases, animal and vegetable oils and fats, and in organic solvents, such as petrol, alcohol, chloroform, etc.

It is slightly soluble in water (under 1%), but the solution is dangerous to handle. On solution it is gradually hydrolysed to a harmless compound.

(3) *Persistence and powers of penetration.*—Like an oil it penetrates most ordinary substances, but does so more readily. Once it has penetrated, being persistent, it will give off toxic vapours for a time depending upon the prevailing weather conditions. The vapour of mustard gas readily penetrates all ordinary clothing.

(4) *Odour.*—Since at present the most sensitive means of detecting mustard gas in the field is by the human nose, it is important to be able to recognize its characteristic odour. It has been likened to mustard, to horse radish, onions and garlic. It is important to remember that, as with other odours, the sense of smell becomes quickly fatigued, so that after a time in a mustard atmosphere one fails to recognize it. On breathing pure air for a short time, as for instance by wearing a respirator, the sense of smell recovers.

(5) *Toxicity.*—Both as vapour and as liquid, mustard is exceedingly poisonous. A drop 1 mm. in diameter will produce a blister the size of a sixpence. But it is essentially a local poison, acting only on those tissues with which it comes in contact. The eyes are the organs most sensitive to mustard gas, next the lungs and respiratory passages, and last the skin.

(6) *Insidious action.*—Small drops of mustard falling on the skin do not attract attention by a sensation of cold as do more readily volatile substances, nor do they at once cause smarting or other sensations, so that contamination may be unsuspected.

(7) *Delayed action.*—There is always a delay before the onset of the signs and symptoms. This period depends upon the concentration of the gas and the length of exposure. The action is cumulative, so that prolonged exposure to low concentrations may result in injury.

It is important to note that although we speak of a delayed action in mustard gas poisoning, this delay is only clinical, i.e., no gross signs or symptoms are manifest until some hours after exposure. In reality, damage to tissue begins immediately mustard gas has penetrated the cells, and as early as ten minutes after its application to the skin of a rabbit, microscopic examination gives evidence of damage in pyknotic nuclei, shrunken cells, dilated blood-vessels and commencement of leakage from the blood-vessels.

(8) *Delayed healing.*—Mustard gas penetrates the skin rapidly, and once it has penetrated deeply there is marked delay in healing of the resulting lesion. The tissues are devitalized, and as a result are readily abraded by rubbing or pressure, and form an excellent nidus in which organisms flourish. On the other hand, if the injury is only a mild inflammation or superficial blisters, the condition may clear up in a few days.

(9) *Sensitivity.*—Some persons are hypersensitive to mustard gas. It is not yet certain what proportion of an average population such hypersensitives would form; it would probably be very small. Hypersensitivity can be acquired, and some research workers, after a series of mild burns incurred during experiments, have become so sensitive that if only minute traces of mustard gas are present they react fairly severely. It may be that amongst troops repeatedly exposed to mustard gas such acquired hypersensitivity would become a serious matter.

Mode of action.—In spite of prolonged and exhaustive research, we are still ignorant of the mode of action of mustard gas. We know by microscopic examination of sections of skin and other organs the sequence of events following its application, but we know little or nothing of the underlying mechanism by which these events are brought about.

Some fourteen hypotheses have been advanced to explain the action of this substance, but in every case either experimental observation has disproved it, or experimental confirmation is lacking. I shall, however, outline the more important of these to illustrate the complexity of the subject. The earliest is:—

The acid hypothesis.—Mustard gas on hydrolysis breaks up into hydrochloric acid and thiodiglycol, and it is believed by the supporters of this theory, amongst whom are Marshall and his co-workers in America [1], that this liberation of acid causes the damage in the tissues.

Peters and Walker [2], however, in this country have shown that the rate of liberation of acid in a series of allied compounds does not run parallel with their vesicant action. Many substances which liberate acid are non-vesicant, and vice versa. They further point out that the cell, by means of its buffering system, is well able to cope with small quantities of acid. Application of alkalies to a mustard burn aggravates rather than alleviates it.

The sulphydryl hypothesis.—This was developed as the result of investigating the possible interference of toxic agents in oxidation-reduction processes. It postulates that irritant action is the result of destroying the sulphydryl constituent of tissue. There is no evidence that mustard gas itself affects the sulphydryl group, but mustard

gas on oxidation forms a sulphone, and although *in vivo* no evidence has been obtained of the sulphone affecting the SH group, *in vitro* it was found that sulphone did inhibit oxidation involving this group.

The sulphone of mustard gas has been shown to be on injection more toxic than mustard gas itself. We have, however, been unable to obtain any evidence of the presence of sulphone in the tissues after the application of mustard gas.

Lewis [3] thinks that mustard gas acts by the liberation from the cells of a histamine-like body. This may be so, but it does not explain how mustard gas initiates the production of such a substance.

Stimulation of sensory nerves.—Dixon [4] claimed that mustard gas acts by stimulating sensory nerve endings, which initiates an axon reflex with resulting dilatation and leaking of capillaries. It has, however, been found that mustard gas is quite effective on denervated skin.

It will be seen from this brief summary that none of the hypotheses so far put forward has given a satisfactory explanation of the action of mustard gas, nor has it been found possible to determine whether the sulphur atom or the chlorine atom is responsible for its toxicity. The clinical picture of mustard gas poisoning is well known from official textbooks.

After this brief survey of its characteristics we will turn to the problems which will confront us should mustard gas be used in another war.

We must first consider the ways in which it was used in the last war, and compare their effectiveness with those in which it might be used in future. The only weapon used to distribute it during the war was the artillery shell. In some cases the shell was fitted with a burster just sufficient to open it and disperse the liquid, causing gross contamination of the object on which it fell—a contamination likely to persist for a considerable time. In other cases the burster was more powerful, distributing the mustard in fine drops, whereby the immediate danger from vapour was increased, and the persistence lessened. That these methods were effective, witness the number of casualties produced. It is thought, however, that under the conditions of static warfare these casualties were caused by men carrying contaminated soil on their clothing or boots into dugouts and billets, and that the mustard gas vapourizing from such contaminated clothing gassed the wearers and their companions. It is probable, too, that a large number of casualties were due rather to exposure to vapour than to contact with liquid.

But mustard gas can be so distributed as to expose troops to greater danger, either by contamination by liquid drops or by much heavier local concentrations of vapour. I refer to distribution from aircraft. Aircraft were never used for the discharge of gas bombs during the European War, but it is said that the Spaniards discharged mustard gas bombs in their war against the Riffs. Mustard gas can also be sprayed from the air in much the same way as smoke curtains are laid, or crops sprayed with insecticides; it will come down from great heights, and drops will travel in an effective form with the wind, so that troops in the open could be sprayed by an aeroplane several miles away and at a great height above them. During a retreat or in defensive operations mustard gas can be distributed by watering carts or watering cans.

Therefore in a future war, if gas is used, troops may be subjected to more severe contamination than hitherto, with consequently severer injuries necessitating more

prolonged treatment. Further, this weapon, if used from the air, may affect not only troops in the fighting line, but also those on the lines of communication and at bases; hence every man must be constantly on the look-out for contamination.

Mustard gas has great penetrant powers, whether as vapour, or as liquid; no ordinary clothing will keep it out for more than a few minutes, and if the skin is contaminated, defensive measures must be quickly taken if burns are to be prevented. If, then, troops on the march, or in attacking formations, may be sprayed with mustard gas, it appears a very difficult problem to arrange changes of clothing and decontamination in such circumstances. The Medical Services must expect to be called upon to treat large numbers of casualties, and to dispose of their contaminated garments and refit them.

Suppose, again, a gas attack is made from the air during disembarkation and concentration of a force, demands for hospital accommodation may prove far larger than those estimated for in the early stages of a campaign.

Before discussing the measures for meeting such situations, it is well to state the general position of the Medical Services as regards defence against gas.

Advice on protective measures against gas is not the function of the medical officer; this responsibility falls upon the officer commanding the formation or unit, and he will be advised either by specialist officers, or, in the case of units, by one of his own officers who has been specially trained at the Anti-Gas Wing Small Arms School. Of course, the medical officer, if commanding a unit, has the same responsibility in this respect as any other commanding officer, but the A.D.M.S. of a division, for instance, is not the responsible adviser of the G.O.C. in anti-gas measures.

We can now consider counter-measures against mustard-gas attacks.

Collective protection.—If chemical weapons are used from the air there will be need for constant vigilance so that the presence of gas may be recognized. This need emphasizes the fact that the gravity of the menace of chemical weapons is in inverse proportion to the degree of discipline and training of the troops exposed to it. The history of gas casualties in units in the war makes this abundantly clear. Unfortunately, at present we have no simple chemical means suitable for use in the field for detecting mustard gas. The International League of the Red Cross last year offered a prize for such a detector, but the competition produced nothing of value. We have therefore to rely on sight or smell to detect mustard gas. As generally used in war, it leaves a dark stain, but it is by no means certain that this will always be so. At present the nose is our most reliable detector.

Every endeavour is being made to train troops to recognize the gas. In peace training it is not possible to use so dangerous a substance; we have, therefore, sought and found a relatively harmless substance which smells somewhat like mustard gas, and this is now used for training purposes.

Once contaminated, clothing and equipment must be rapidly disposed of and cleansed, and this is one of the most serious problems. In a war of movement the difficulties of getting large stocks of clean clothing to forward areas, and of cleansing that which has been contaminated, are very great. It seems to me that if gas is used in such circumstances against front line troops it is inevitable that large numbers will suffer from burns, since it will be impossible to provide changes of clothing before the damage is done. There are, however, certain individual protective measures which we will consider later. Some special organization will be necessary

in order to deal with contaminated clothing and equipment, and at present the authorities are considering what form it should take.

There are several ways of getting rid of mustard gas, but if contamination is heavy, all demand fairly elaborate apparatus, which would be difficult to move further forward than railhead or some similarly organized post on the lines of communication. If the contamination is from vapour only, twenty-four hours' exposure in the open air in this climate is sufficient to render clothing safe to wear. This time can probably be considerably reduced in hot countries. Boiling for half an hour will also destroy gross contamination, and this is the method of election for oilskin protective clothing. All textiles can be decontaminated by steam, but the process is elaborate, and in many cases, if the contamination is gross, it may be better to destroy the articles. For leather articles, for machinery, rifles, guns, etc., bleach is the best decontaminating agent. It can be used either as a powder, a paste, or cream with water, or as an ointment made up with petroleum jelly.

With the exception of exposure to air, all these methods demand fairly elaborate organization, and their use in forward areas is at least limited. If forward medical units receive large numbers of casualties, they will certainly have to dispose of large quantities of contaminated clothing and equipment for this purpose, and will have to be linked up with the cleansing units on the lines of communication.

Individual protection.—The respirator is a perfect protection for those parts of the body which it covers. Further, the modern respirator does not cause the discomfort and loss of efficiency of the war-time apparatus, and can be worn for hours without causing serious inconvenience. With highly trained troops, therefore, it should be possible to minimize the eye and lung casualties from mustard gas. To prevent skin burns is much more difficult. Mustard gas as liquid or vapour rapidly penetrates everything but air-proof fabric. Air-proof suits can only be worn for limited periods, even in temperate climates, and are useless in the tropics. We do employ them—ordinary naval oilskin is quite effective—for personnel engaged on special decontamination work, but only spells of work of about half an hour's duration can be undertaken without exhaustion. Several such spells can, however, be carried out in a day.

The Mark VII cape ground sheet affords good protection against penetration by mustard gas. With the shrapnel helmet, the ground sheet and the respirator, a fair amount of protection can be given. The addition of protective gloves and leggings is also contemplated.

All our efforts to find an effective and durable method of impregnating ordinary clothing to withstand mustard gas have up to date been unsuccessful.

If contamination occurs it must be quickly removed, or burns of varying degree, depending upon the concentration of the poison and the length of exposure, will result. Soap and water is effective, but the scrubbing must be thorough and prolonged. A more practical preventive for front-line units is bleach ointment. This is made up with equal parts of bleaching powder and petroleum jelly. The mixing must be thorough. In temperate climates if this ointment is applied to the contaminated skin within five minutes, even very gross contamination with liquid mustard can be neutralized, and no burn will result. The ointment has not so far proved so successful in hot climates, but further experimental work is being carried out. The ointment does its work with a very short period of contact—three to five

minutes—and we have found that even repeated applications for short periods do not cause dermatitis.

From this brief survey it will be seen that, though the danger from mustard gas is serious, particularly if used from air weapons, much can be done to lessen it, particularly with highly-trained troops who have been taught to recognize the poison.

The problem of mustard gas is similar to that of malaria prevention, as we met it in the eastern theatres of war. Casualties are inevitable, and there is no panacea for prevention, but intelligent application of known preventive measures, with strict training and discipline, will minimize them.

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Editorial.

A STUDY IN NUTRITION.

In an Editorial in the July number of the Journal, 1931, we drew attention to a study in nutrition carried out by Professor Cathcart for the Medical Research Council. We then pointed out that a knowledge of normal quantitative standards of diet at different ages and under different conditions of work and environment was needed by those responsible for the feeding of communities, whether in institutions, such as asylums, prisons and schools, or in national services, whether civil or military. That this knowledge was of special importance in times of grave national emergency, when, as in the last war, rations for the whole nation had to be calculated and imposed. It is perfectly easy to devise a diet which will agree with the accepted canons of dietetics, but such a diet may diverge widely from the composition of the freely selected diet. It has been contended that the deductions drawn from the dietary habits of communities may be quite fallacious, but years ago Sir William Roberts put forward the view that long-established food customs cannot be ignored as they represent "the fruit of colossal experience accumulated by countless millions of men through successive generations."

Before Professor Cathcart commenced his studies, most of the data available for the guidance of those responsible for national policy were drawn from foreign countries, especially America, where the populations lived under different climates and other conditions of environment, and generally dealt with one class of worker at one economic level. In the study at St. Andrews, which we dealt with last year, Professor Cathcart's observations were made on a relatively well-to-do community, whose dietetic habits were more likely to reflect those of this country at large than do the American data, and on a vertical section of the community so as to include all classes.

The method of study consisted in determining the man value of the different members of a family, and the food distribution in the average household. We referred to these points in our previous editorial and need only state that, for the determination of the man value, Cathcart used a combination of Atwater's and Lusk's figures. Boys and girls of the age-group 14 and up were given values which are the same as those of the father and mother. At the age-group 12 to 14 the values were higher than those of Atwater and Lusk. Cathcart and his co-workers were tempted to give this group even higher values, as they had reason to think that children at or about puberty eat more than their fathers, especially when the parent does not belong to the working class.

In the study at St. Andrews, it was found that in the family diets there

was a much greater amount of fat, and much less protein, than in the standard diets of Voit and Rubner.

The results agreed very closely with the data collected by Dunluce and Greenwood in their research on the dietaries of munition workers.

Professor Cathcart, assisted by Dr. Murray and Miss Shanks, has just completed an inquiry into the diet of families in Cardiff and Reading. In their studies they have taken a horizontal sample of two very divergent, so-called working class, populations. They say that a critical examination of their results with a fairly well-to-do population at St. Andrews convinced them that investigation of the diets of those financially comparatively well-off, though interesting, is unnecessary. Though these people have abundant choice in the selection of their diet, yet they do not consume inordinately large quanties of food. In the studies at Reading and Cardiff Cathcart used the same methods and basal data as at St. Andrews, and obtained two more or less identical studies of the nature of the diet consumed by the industrial class in the two towns in question. In Cardiff, 56 accurate family studies, comprising 378 individuals, and in Reading 57 accurate family studies, comprising 370 individuals, were carried out. The two collections of families were very similar, except that the dock workers of Cardiff were replaced by other trades in Reading and more unemployed families were present in Reading.

The general results of the studies are given in two tables, from which it appears that while the percentage yield of energy from the various proximate principles is much the same, the Cardiff families have a diet of higher calorie value. This is obtained by a very slight increase in the protein and a definite increase in the fat and carbohydrate intakes. In Cardiff the families not only spend more on rent, but their weekly expenditure on food per man is higher, in spite of the fact that the man value is higher.

In Cardiff the diet per man per day contained protein 78·7 g., fat 113·6 g., carbohydrate 440·9 g. The calories were 3,174, and the expenditure on food per man weekly was 8s. 6d.

At Reading the figures were: protein 75 g., fat 100·8 g., carbohydrate 408·2 g., calories 2,906, expenditure on food per man weekly 7s. 3¾d. The man value at Cardiff was 4·55 and at Reading 4·35.

Though the figures for Cardiff are not very different from those of the mixed population at St. Andrews, Cathcart considers that it would be fairer to compare them with similar studies of less well-to-do populations in Scotland. For instance, at Glasgow in 1921, with a mean income per man per week of 12s. (Reading 12s. 8¾d.), the protein was 72·9 g., fat 77·6 g., carbohydrate 352·5 g., and calories only 2,466. In Dundee in 1923, with an income of 12s. 9d., the figures were protein 63·1 g., fat 59·6 g., carbohydrate 337·4 g., calories 2,197. The Reading and Cardiff values are more nearly comparable with the Glasgow artisan class which in 1924 is shown as obtaining a diet containing protein 87·9 g., fat 96·8 g., carbohydrate 441·1 g., calories 3,070. The total energy value of the Cardiff diet is slightly above

the Glasgow artisan value, but with the protein content a little below, the fat content definitely above, and the carbohydrate values practically identical.

The Reading diet also closely approaches the Glasgow artisan class. It should be noted that the fat content of the two English diets is higher than that of the Scottish diets. This is considered to be, in part, due to the difference in the cost of living between the assessments of the Scottish diets in 1921 and 1924 and those of the present day; but racial idiosyncrasy also possibly plays a part. The difference in the amount of fat cannot be ascribed to marked difference in income between the communities.

It is interesting to note that the Glasgow families, out of an average man income per week of 12s., spent 78·7 per cent on food. The Dundee families, out of a man income of 12s. 9d., spent 44·3 per cent on food. The Cardiff and Reading families, out of man incomes of 14s. 11d. and 12s. 8d., spent 56·9 and 56·5 per cent on food respectively.

A study of Cardiff and Reading families grouped with regard to total incomes showed that the Reading families were economically on a definitely lower level than those of Cardiff. While only 53 per cent of the Cardiff families have incomes below £3 a week, in Reading 72 per cent have incomes below £3. This economic difference is reflected in their diets. With a rising income there is a definite rise in the consumption of fat, a rise not necessarily accompanied by an increase in the protein intake, and it may be inferred that this increase in the fat intake is not due to the consumption of meat. The intake of protein showed no definite relation to income; though in Cardiff the families with the largest incomes consumed most protein, this was not true of Reading. In Reading the yield of calories from protein showed a steady fall from the families with the smallest incomes to those with largest, viz., from 11 per cent with incomes from £1 to £2 a week to 9·9 per cent with incomes of £4 and upwards. At Cardiff, on the other hand, the protein calorie yield remained practically constant.

As regards the calorie intake, at Cardiff this remained much the same, just over 3,000 for incomes rising from £1 to nearly £4 a week, but for incomes £4 and upwards the calorie intake rose to about 3,500, and there was a marked increase in the consumption of fat. At Reading, even with an income of £4 and upwards, the calorie intake did not rise above 3,132 and the consumption of fat was not so marked. The difference between the two populations seemed to lie in the fact that for one reason or another the Reading people spent less on food. With an income of £4 and upwards at Cardiff, the expenditure on food per man was 10s. 3¼d., but at Reading this class only expended 7s. 7d. per man on food.

Where the families were grouped according to the yield of calories per penny spent, it became evident that at Cardiff with a rising return in calories per penny there was a steady fall in the amount both of protein and fat in the diet and also of the total calorie yield, while the carbo-

hydrate yield remained comparatively constant. At Reading, with a rise in the return per penny spent, there was a steady fall not only in the total calories, but in the amounts of the three proximate principles.

Studies of unemployed families in Cardiff and Reading showed a marked difference in the percentage of income spent on food. The Cardiff families, which had a weekly income per man of 9s. 6¾d., spent 77 per cent of it on food. They obtained: 75·2 g. of protein, 95·1 g. of fat, 457·8 g. of carbohydrates and 3,056 calories. The calories per penny were 263·4. The Reading families, with an income of 10s 10½d., expended 58 per cent on food and obtained: 71 g. protein, 98·5 g. fat, 379·5 g. carbohydrate and 2,751 calories. The calories per penny were 263·7, practically the same as at Cardiff. In Reading there was more fat and less carbohydrate in the diet, and though the calorie value was lower, the diet was preferable to that at Cardiff.

Cathcart and his co-workers devote a section of their report to the consideration of "poor diets." They say that a good deal is written and spoken about diet, and though there is a widespread academic interest in the problem of diet, the practical question with the majority of people is whether there is enough to eat. In the case of those whose incomes barely suffice to purchase the necessary material to maintain life, the proper expenditure of the available funds is of real importance. Hence the desirability of making a serious study of the diets of families who, according to the current man value calculation, obtain 2,500 calories and under per man. Cathcart asks: "How, if food be the material which makes good the wear and tear and supplies the energy for the performance of work, can this necessary repair substance and energy be obtained from intakes of 2,500 calories and less, assuming that the recipients are healthy." The study made at St. Andrews, to which we referred in our previous editorial, seems to supply the answer to this question. Fairly reliable evidence suggested that the wage-earner is never reduced to this low level. Those who suffer are the wife and possibly the children.

Catchcart considers that smallness of income is only partially responsible for these low diets. Of far more importance than the size of the income is improvidence on the part of one or both parents, or general incapacity. He says also that to those accustomed to Scottish dietary studies, the English studies brought out two facts very clearly, viz., the relatively low percentage of the income, at this level, spent on food and the relatively high charge of housing. Very few of the Scottish families with comparable incomes would be found paying 14s. to 15s. a week for housing accommodation.

The diets of eight families in Cardiff and twelve families in Reading who received less than 2,500 calories per man and spent 54 per cent of the income on food were studied. The mean values of the eight Cardiff families were as follows: Diet per man per day: protein, 60·5 g.; fat, 76·6 g.; carbohydrate, 348·9 g.; calories, 2,380. The total calorie value is nearly 800 below the general mean for Cardiff, due to a fairly uniform

fall in the consumption of all three proximate principles. The lowest calorie value per man in the Cardiff diets was 2,125 and the highest 2,493.

In the case of the twelve families in Reading the mean values of the diet per man were: protein, 57·6 g.; fat, 74·7 g.; carbohydrate, 310·2 g.; calories, 2,193. Some 54 per cent of the weekly income was spent on food, although the average income was 2s. lower than that of the Cardiff families. The Reading diet is poorer in all three proximate principles and in calorie value. The worst Reading diet had an energy value of only 1,708 calories. About 48 per cent of the income was spent on food. The poor diet cannot be wholly attributed to small income, as the income per man per week was 8s. 2¾d. Another family with an income per man per week of 7s. 2¼d. obtained 2,458 calories, but they spent 78 per cent of of their income on food. In the first household the wife is stated to have been happy-go-lucky, careless and cheerful, while in the second she was a struggling, intelligent woman.

Cathcart and his co-workers then investigated the relation of diet to parental capacity. They state that in both Reading and Cardiff the standard of parental efficiency was fairly high, and that parental goodness does play an undoubted role in the nature of the household diet both as regards quantity and quality. There was a curious difference between the inhabitants of Cardiff and Reading. The good mothers in the former town expended 54 per cent of the total income on food and the bad mothers nearly 70 per cent; whereas in the latter town the good mothers spent about 58 per cent and the bad mothers 45 per cent of their income on food. The result may have been due to mere accident, to the fewness of the families available, or to a fundamental difference between the inhabitants of the two towns.

The question naturally arose as to the adequacy from a general health point of view of these diets. Objective examination of the various members of the different families did not suggest any serious malnutrition. If malnutrition had existed the children should have shown some signs of under feeding. But the Cardiff children both in height and weight were found to compare very favourably with the average of the great body of English school-children incorporated in the data of A. Greenwood, and with the more limited body of figures supplied by the Cardiff School Medical Officer.

The same deductions could be drawn from the results of the observations on the Reading children. These children were also compared with certain groups of school-children in the Reading area, and Cathcart's sample was found to be a fair average sample, or perhaps even just above an average sample of the Reading children. The report concludes with the statement that "judging from the state of the physique of the admittedly limited number of children at our disposal there is no evidence of serious malnutrition in the families studied."

The average calorie intake was approximately 3,000 calories. The

percentage derivation of calories was 10 per cent from protein, 32 per cent from fat and 58 per cent from carbohydrate.

The Advisory Committee on Nutrition of the Ministry of Health in a memorandum to the Minister on "The Criticism and Improvement of Diets" state that the calories per man per day should be 3,000. "Any deficit greater than 10 per cent should be viewed with suspicion, in the first place because the figures chosen as standards are not very generous, and in the second place because no account has been taken of wastage. (It is a common experience that there is considerable wastage of fat in institutions.)"

It will be noticed that Cathcart's studies relate almost entirely to calorie intake. The idea was to help those who have to devise diets for the use of specialized communities, e.g., inmates of Poor Law institutions, and to give them accurate data regarding the food actually consumed by people who have the purchasing of their foodstuffs within their own control. The recommendations to the Ministry of Health were probably based on the results of Cathcart's studies, but the memorandum deals with other important criteria of a diet, viz., the quantity of first-class protein, the supply of mineral matter and the vitamin content of the diet. In practical dietetics, first-class protein is found only in animal protein such as that in cheese, eggs, fish, meat and milk. The absolute amount necessary per man per day is stated to be 37 grammes; and the percentage content of the total calories is 5. Most middle-class diets have about 55 grammes first-class protein; but working-class diets frequently fall below the standard and any deficit is probably detrimental.

The foods which supply mineral matter and vitamins are often spoken of as "protective" foods. Fortunately, the foods which are useful in supplying mineral matter are useful in supplying vitamins. Liver and egg-yolk are good sources of iron and also supply vitamin A, and eggs yield in addition vitamin D; milk and cheese, which supply calcium, furnish vitamin A.

The chief mineral elements essential in a diet are calcium, phosphorus, iodine and iron; there is evidence that frequently too little calcium, iodine and iron is present. Calcium is most likely to be deficient.

There are no quantitative data regarding the human need for vitamins. In our editorial last month we drew attention to the most recent work on this subject.

The memorandum emphasizes the fact that a diet cannot be regarded as complete unless it contains a suitable amount of calories, first-class protein, mineral matter and vitamins. "No amount of calories will make up for any other deficiency and no amount of vitamins and mineral matter can make up for a deficiency in calories or of first-class protein. A diet must stand foursquare upon calories, first-class protein, mineral matter and vitamins."

Clinical and other Notes.

THE EMPLOYMENT OF THE PORTABLE PUMP IN ANTI-MALARIA SCHEMES.

BY CAPTAIN J. D. CORNER,
Royal Army Medical Corps.

(1) TEMPORARY BREEDING AREAS.

IN this station, Kamptee, India, for some years one of the greatest handicaps encountered in any anti-malaria scheme has been the maintenance of effective drainage of monsoon and post-monsoon rain-water which supplies the chief temporary breeding areas.

Though the number of fresh cases of malaria in the last few years has been small, there has been a continual yearly incidence. The majority of these cases have been infected when residing in the vicinity of certain swampy areas. The nature of the ground—loose, sandy cotton soil—precluded effective drainage since the walls of any kutcha drain fell in practically immediately after it had been opened up. Further, the areas in question were really difficult to drain effectively, as no sooner had one area been cleared than with a further day's rain the ground offered fresh pits and depressions which remained to be cleared. A fresh problem presented itself this year in the shape of drainage of water from areas recently excavated in solid rock.

Permanent drainage of these areas had long been considered, but in the present financial stringency no countenance could be given to such a proposal. An estimate for drainage of one small area alone was Rs. 1,200, and our actual balance in Military Engineering Services grant and Anti-Malaria grant fell considerably short of this amount.

Oiling was unsatisfactory and expensive. The problem set us was solved by the purchase of two small hand-operated rotary pumps at Rs. 25 each. These pumps were fitted to a strong wooden base with carrying rings at each corner (fig. 1). They were carried from place to place as occasion demanded, together with a ten-foot length of piping and a twenty-foot length of canvas hose, and set up by supporting props near the area to be drained (fig. 2).

The water could be dealt with in various ways: (1) By pumping and spraying widely over ground; (2) by pumping water into neighbouring pukka drains; (3) by pumping into buckets, carried by coolies to neighbouring pukka drains; (4) by pumping small collections of water into one large central pool which could be heavily oiled pending disposal of its contents.

The pump also offered an ideal method for the drainage of buffalo pits and the clearance of water underlying culverts, situations which are at all times difficult to treat.

By these means water was cleared from breeding areas in a far more expeditious and satisfactory manner than would have been the case by kutcha drains, which require continual clearing and supervision.

The economical nature of this form of drainage is manifest, for the total cost of clearing some 2,000 gallons of water from rock pools mentioned above was Rs. 4—the pay of the pump coolies.

These pumps require no supervision and there are no delicate parts to get out of order. There is, therefore, no recurring expenditure.

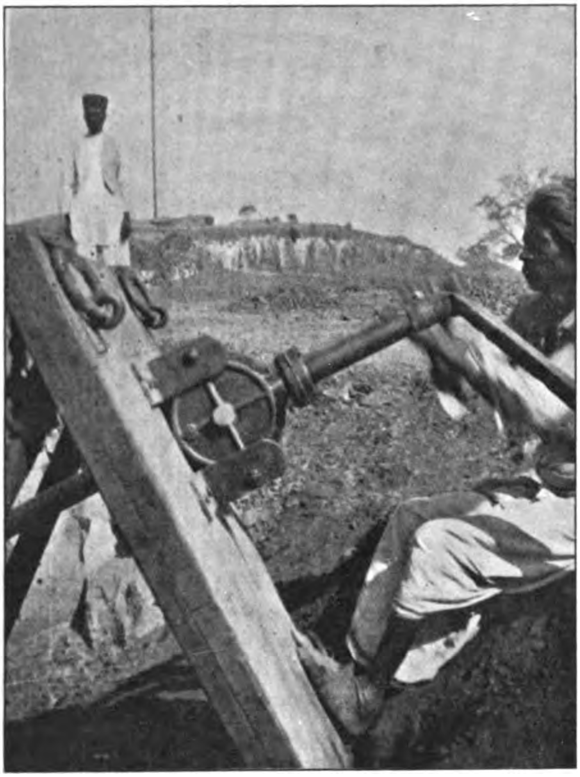


FIG. 1.

Owing to the exceptionally heavy and lengthy monsoon this year (1931), it is impossible to compute the effect of efficient drainage on the malaria incidence, but it is certain that in normal years the immediate disposal of breeding areas by these methods cannot but have a salutary effect.

(2) PERMANENT BREEDING AREAS.

On the cessation of the monsoon and the dispersal of temporary breeding areas, it was considered that these pumps might be directed against permanent breeding places.

One such place existed. The main permanent barrack drain stopped short opposite the Indian infantry lines and the water flowed into a nullah of irregular depth. From this nullah there was no drainage and water lay there for lengthy periods. To continue the permanent drain to a situation where water could safely be disposed of meant an expenditure by the Military Engineering Services of Rs. 5,000. As money was not available, the procedure adopted was as follows:—

At the termination of the main pukka drain a sump-pit with a platform

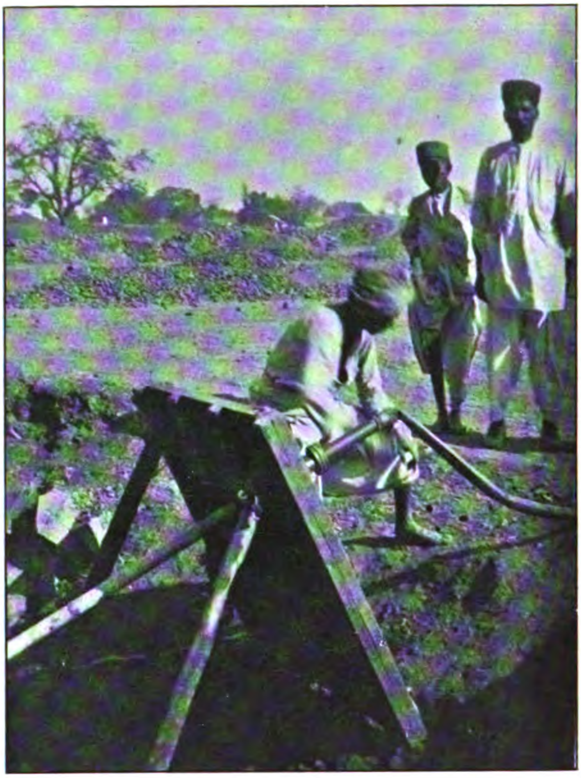


Fig. 2.

was constructed to act as catchment for water issuing from the drain. The small rotary pump was then fixed to two upright girders. Piping was led off to stand-pipes some thirty feet away and from these the water was sprayed over the ground. One coolie doing a few hours work a day was now able to keep the whole area perfectly dry. Fig. 3 shows the pump in position and the complete absence of water in the nullah to the right may be noted.

From our experience here these pumps are strongly recommended as a useful equipment for any anti-malaria officer whose areas are badly drained and whose finances for the active prosecution of his work are limited.

The small pumps mentioned above were purchased from Messrs. Walter Leslie, Calcutta, and it is hoped, out of the next anti-malaria grant, to purchase a larger type.

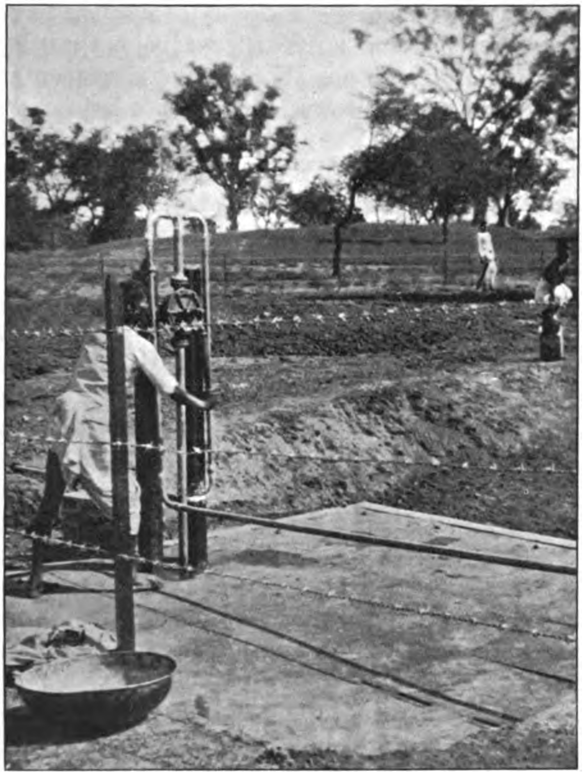


Fig. 3.

We have been extremely fortunate in having an enthusiastic Sub-Divisional Officer of the Military Engineering Services whose practical suggestions have been invaluable in anti-malaria work in this cantonment.

A CONSIDERATION OF CERTAIN POINTS IN THE TREATMENT OF AMŒBIC ABSCESS.

By Major A. G. BIGGAM, O.B.E.,
Royal Army Medical Corps.

The generally accepted present-day treatment of amœbic abscess of the liver is by aspiration of the contents, combined with intramuscular emetine injections; this procedure leads to cure in the great majority of cases without the necessity of open operation. After aspiration it is always advisable to make a bacteriological investigation of the first fluid with-

drawn to insure its freedom from pyogenic organisms, for though ninety per cent of amœbic liver abscesses are sterile, occasionally a case is met with in which the presence of septic organisms detected on direct microscopic examination or shown by numerous colonies grown on the plate necessitates open drainage of the abscess cavity in order to obtain a cure. Even when no organisms are present, one must always be prepared to repeat the aspiration on one or more occasions should signs of reaccumulation appear.

The thickness of the liver abscess content not infrequently renders its removal difficult, even when the largest-sized cannula of the Potain's apparatus has been employed. We have, however, seldom experienced trouble with the aspiration, provided the general condition of the patient has been sufficiently good to allow of the employment of intramuscular emetine for some days, preferably up to seven if possible, prior to withdrawal of fluid being attempted. This emetine administration allows the liver cells at the peripheral part of the abscess to recover from the ill-effects of the action of the *E. histolytica*, and in some cases may even bring about a complete cure of the hepatitis without any further interference; when however, as usually occurs, the abscess still persists despite several days' emetine treatment, thinning of the central part of the content has usually resulted from the emetine medication and the aspiration is thus made easy.

The drug usually employed in the treatment of amœbic hepatitis is emetine given intramuscularly, but other medicines have occasionally been recommended as a cure for amœbic inflammatory conditions of the liver. Two cases of amœbic abscess recently under my care are of interest, demonstrating the unreliability of certain of these other drugs in preventing the development of abscess formation.

Case 1: G. K. H., male, aged 20, was admitted on October 25, 1931, complaining of diarrhœa and the passage of blood and mucus associated with tenesmus. The onset was sudden with ten motions on the first day of the disease and the symptoms persisted for five days. No previous history of diarrhœa was obtained. The stools were almost pure blood and mucus, and abdominal colicky pains were marked.

On examination the patient's general condition was found to be bad; he looked very toxic, dehydrated; eyes were sunken and tongue dry; the pulse was weak, 108 per minute; temperature 38·9° C. No enlargement of the liver could be detected on careful examination. The abdomen was tender all along the course of the large intestine. Active *E. histolytica* were found in the stools.

Sigmoidoscopic examination revealed big sloughing amœbic ulcerations with small areas of healthy mucosa in between.

Laboratory investigation of the stools failed to reveal any other cause for the dysenteric symptoms apart from the amœbic infection.

Owing to the patient's poor general condition, emetine was withheld and he was put on a yatren enema, 250 cubic centimetres of 2·5 per cent solution daily, and stovarsol 0·25 g. t.d.s. He retained the enema very well

and his dysenteric symptoms rapidly improved; blood, mucus and diarrhœa being absent and examination for *E. histolytica* negative on November 3, ten days after the commencement of treatment. Treatment with yatren and stovarsol was continued to complete twelve days in all, after which the patient's general condition was good, his abdomen was quite comfortable, no tenderness now being elicited on palpation over the large gut.

The patient's condition progressed satisfactorily till November 9, when he developed an evening temperature of 38·5° C.; this recurred each evening, and his general condition gradually became less satisfactory although the bowel symptoms were still entirely absent. On November 13 signs of enlargement of the liver were detected, the leucocytic count being then 24,000 with polymorphs 89 per cent.

The liver was explored on November 14 and 600 cubic centimetres of amœbic liver abscess material removed.

Case 2.—T. M., hospital No. 23,529, aged 45, was admitted on December 19, 1931, with dysenteric symptoms.

The disease began one month prior to his admission, the onset being gradual and not associated with any fever or other signs or symptoms of general toxæmia. Actively mobile *E. histolytica* were demonstrated in the stools by the microscope, and sigmoidoscopic examination revealed small discrete amœbic ulcers in the lower part of the gut. The liver was not enlarged and there was no tenderness in the region of this organ; there was no complaint of cough and no signs of any lesion of the lung. The temperature was normal and the leucocytic count 7,200.

Treatment was started on December 21, 1931, with one grain of emetine bismuth iodide given by the mouth on the first day, two grains on the second and three grains on the third day, this dosage being continued during the remainder of the course.

Concurrently with this treatment, daily medication with a yatren enema, 250 cubic centimetres of a 2·5 per cent solution, was given, the enema being retained well.

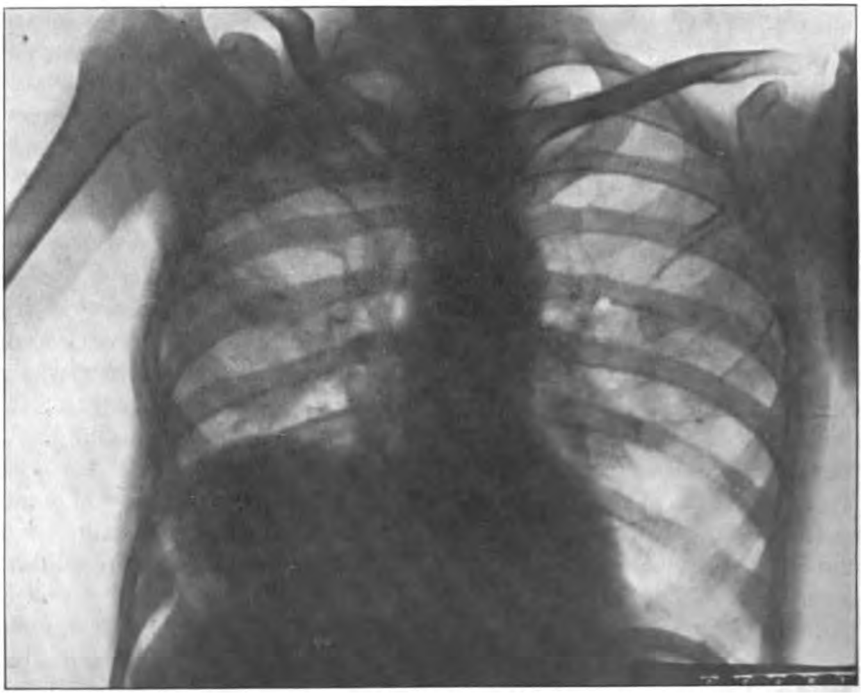
On December 29, ten days after the commencement of the treatment, the patient began to feel some pain in the lower right costal region which was aggravated by deep breathing and coughing; some impairment of air entry was detected in the lower part of the right chest, and two days later some slight dullness on percussion was discovered in this area; occasional faint friction sounds were also heard here.

No pain was ever complained of in the right shoulder region, and there was no increase in temperature or leucocytes—this absence of fever and leucocytosis we have found not infrequently in cases of definitely proved amœbic liver abscess.

On December 31 the patient was X-rayed and a small abscess was revealed towards the base of the right lung, the lower part of the opacity being in contact with the dome of the diaphragm. A needle was inserted in the sixth space in the mid-axillary line and thirty cubic centimetres of typical liver abscess material were withdrawn which later proved to be

sterile on culture. Emetine 0·06 gramme intramuscularly was commenced and continued daily for ten days. The pain which had been complained of in the region of the abscess rapidly subsided and successive radiograms showed gradual diminution in the size of the abscess opacity, until one month after the emetine had been commenced only slight peribronchial thickening remained indicating the site of the healed abscess.

The patient was discharged apparently cured both as regards the primary intestinal condition and the secondary liver complication.



Showing amœbic abscess in the lower part of the right lung of Case 2. Symptoms and signs of this abscess occurred towards the end of a course of treatment with oral emetine bismuth iodide and yatren enema.

These two cases of amœbic dysentery admitted with no signs or symptoms of liver involvement both showed satisfactory improvement in their bowel symptoms, Case 1 on yatren enema and oral stovarsol and Case 2 on oral emetine bismuth iodide and yatren enema; but despite this improvement in their intestinal symptoms both developed an amœbic abscess, the one a few days after completing the course of yatren enema and oral stovarsol, the other towards the end of the course of emetine bismuth iodide and yatren enema.

The occurrence of amœbic abscess in these two cases compels one to accept with great caution any claims advanced as to the curative properties of any drug other than emetine in the treatment of amœbic abscess or even of early amœbic hepatitis.

AN ACCESSORY RUDIMENTARY URETHRA.

By Major A. L. ROBERTSON, O.B.E.,
Royal Army Medical Corps.

Aircraftsman "T" exposed himself to infection on April 18, 1931, while on leave and used an E.T. outfit within an hour.

Noticing a discharge on April 23, 1931, he reported to, and was treated by, a civil practitioner till May 8, 1931, when he returned to duty and was admitted to a military hospital. There it was found that a small abscess had formed above the pubes and was discharging by a subdermal track opening dorsally proximal to the coronal sulcus. Intracellular gonococci were seen in smears taken. No smear could be obtained from the urethra.

Fig. 1.—Before operation.

Fig. 2.—After operation. A wedge has been introduced into the opening of the track.

The abscess was fomented and incised and irrigation of the track carried out through the incision. He was discharged to duty as cured after forty-two days.

On October 8, 1931, he was admitted to hospital suffering from gonorrhœa (relapse).

Urethroscopic examinination showed no sign of infection, and smears taken by loop were blank. A purulent discharge containing gonococci was obtained, however, from the mouth of a track opening in the middle line on the dorsum proximal to the coronal sulcus. This track

extended to above the pubes where there was a small indurated abscess. As irrigation of the track was possible, routine treatment was carried out till smears showed occasional gonococci only.

On the nineteenth day (October 27, 1931) the area was anæsthetized by novocain and a probe passed. The probe did not travel beyond the abscess, but a fibrous thickening could be felt continuing like a cord from the abscess downwards behind the pubes.

The track was slit up to the abscess and the edges sutured back along each side. The lining of the lumen resembled normal urethral tissue. 1-10,000 hydrarg. perchloride was used in wet dressing. Salt packs were applied as a provocative, but no gonococci appeared again. The area healed quickly, a depression remaining from contraction at the abscess site and the patient was discharged to duty.

In the photographs will be seen a dimple on the dorsal rim of the glans —a vestige of the embryonic opening.

I am indebted to Lieutenant-Colonel E. H. Milner Moore, D.S.O., Officer Commanding Royal Victoria Hospital, Netley, for permission to forward this article for publication.

OLD GUN-SHOT WOUND AND FOREIGN BODY COMPLICATED BY *M. CATARRHALIS.*

By Major R. W. VINT,
Royal Army Medical Corps,

AND

Major J. H. C. WALKER,
Royal Army Medical Corps.

Captain J. H., aged 38, was extensively wounded in the left thigh and abdominal wall by shrapnel in 1916. The wounds were not complicated by fracture or gas gangrene and healed completely.

The patient returned to duty on active service and since then he has served continuously in the Far East and other stations and has remained fit until this admission to hospital. He was admitted to the Military Hospital, Malta, on February 11, 1932, suffering from an abscess in the left thigh. On stereoscopic examination, a foreign body was seen situated internal and superficial to the femur.

At operation on February 15, 1932, the abscess was incised, about one and a half pints of thick white pus were evacuated, the foreign body (small piece of shrapnel) was removed and the abscess drained. The pus was sent to the Command Laboratory for examination and culture. The drain was removed on the third day and the cavity closed; the wound had almost healed by March 5, 1932, when the patient was discharged from hospital.

Laboratory Report.—The direct smear from the pus showed large numbers of Gram-negative cocci and diplococci. Morphologically and culturally the organism resembled *M. catarrhalis* and this was confirmed by the fact that it did not ferment carbohydrates. A throat swab showed the same organism to be present in large numbers. The organism was not agglutinated by the patient's serum.

We wish to thank Lieutenant-Colonel B. Johnson, D.S.O., R.A.M.C., for permission to forward this article for publication.

Travel.

A VISIT TO LOBITO.

By Lieutenant-Colonel R. F. O'T. DICKINSON, O.B.E.,
Royal Army Medical Corps.

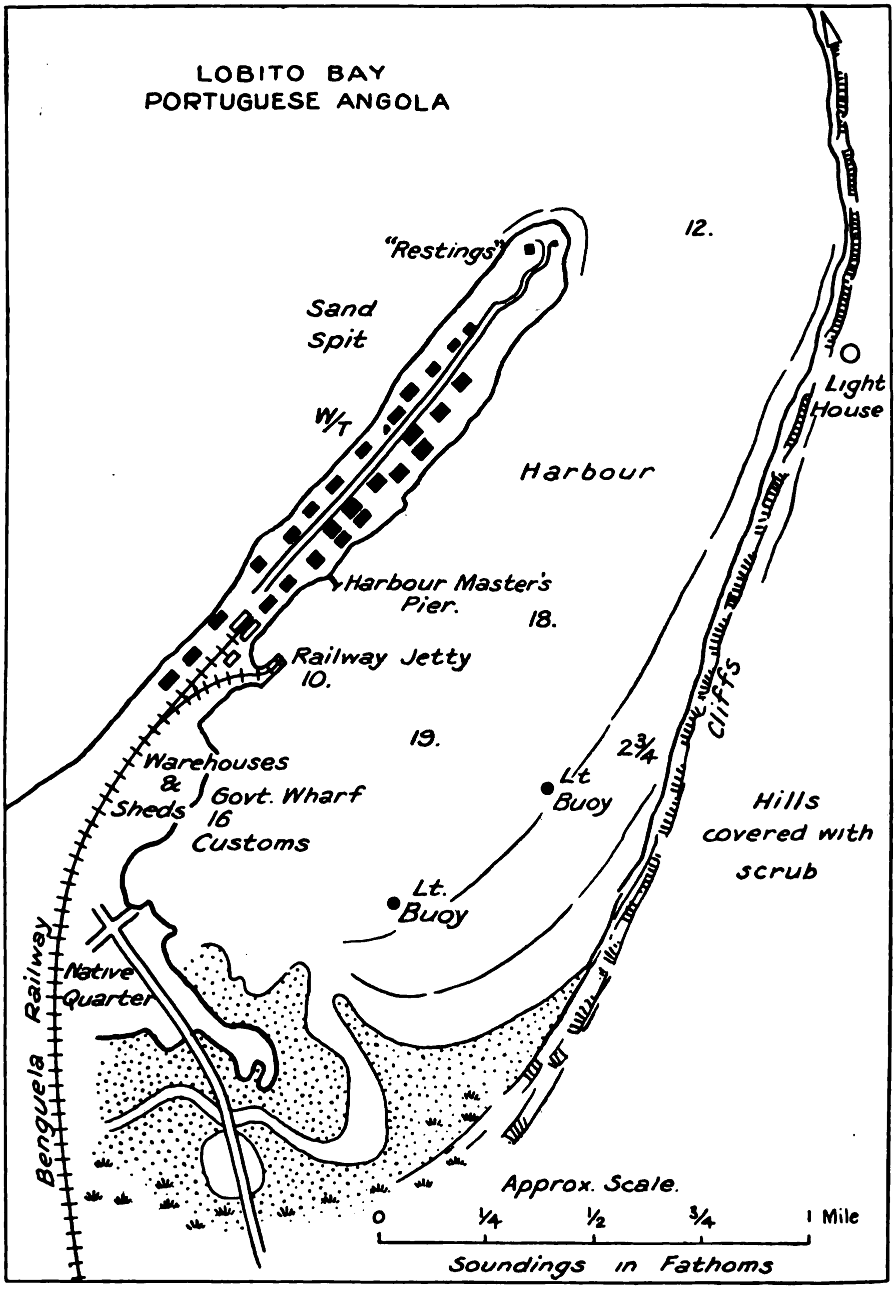
On the journey between Mauritius and the United Kingdom, one of the occasional ports of call for Union-Castle intermediate ships is Lobito, just north of Benguela, in Portuguese West Africa (Angola). As this part is probably very little known, and as the writer has visited it on three occasions since 1924, it is thought that a short account of the locality might prove of interest to officers of the Corps. Lobito lies in latitude 12° S. and longitude 14° E. It has a magnificent natural harbour about 2½ miles long and over one mile in width. The soundings show from over 70 feet in the bay to 35 feet at the quay-side. It will thus be seen that a large number of big ships can be accommodated in the harbour.

The importance of this port lies in the fact that the new line of railway (about 800 odd miles), opened formally in July, 1931, right across Portuguese West Africa, establishes connection with the rich copper-bearing country round Katanga (Belgian Congo), the tin and other mining districts of Northern Rhodesia, and also with Southern Rhodesia, and so on to Beira in Portuguese East Africa. Through trains now run from Lobito to Beira. The Katanga-Lobito route, as compared with the Katanga-Beira route, saves 600 miles of rail transport, and about 2,600 miles of sea transport.

Lobito has thus become a very important place commercially, and one can foresee here a great field for British enterprise in the future.

The town of Lobito is built mainly on a sand spit about 2½ miles long and averaging 300 yards wide, and constitutes the main European residential quarter. The houses are of local brick and cement with wide verandahs, and large airy rooms admitting a thorough through draught. The native huts, storehouses and grain stores are mainly inland.

The climate is dry and not very hot, as there is always a good sea breeze. There are no violent storms in the locality, owing to its situation in the


LOBITO BAY
PORTUGUESE ANGOLA
"Restings"
12.
Sand Spit
W/T
Harbour
Harbour Master's Pier.
18.
Railway Jetty
10.
19.
Warehouses & Sheds
Govt. Wharf
16
Customs
2¾
Lt Buoy
Lt. Buoy
Light House
Cliffs
Hills covered with scrub
Benguela Railway
Native Quarter
Approx. Scale.
0 ¼ ½ ¾ 1 Mile
Soundings in Fathoms

S.E. Trade Zone, and its latitude. There is a good cold weather, and according to the local inhabitants two and even three blankets are appreciated at night.

The rainfall is small at Lobito itself, but the surrounding country inland has a plentiful supply.

The water supply is plentiful and fair in quality. It comes from the Catumbela river, is filtered, and piped into the town.

The population is small, under 2,000 in the town, mostly Portuguese, many of whom have been deported for political offences. There are two dozen English people, who are engaged in business pursuits. The officials are, of course, Portuguese. The Governor lives at Benguela, about twenty-five miles away, and he also has a residence at Lobito, which he occupies occasionally. The natives are principally of Bantu descent, and they are docile, and do not appear to be very intelligent.

Servants are easy to get, but are not good. They are paid £1 a month, plus food and clothing.

Food. Fresh supplies such as meat (3d. per pound), fish, milk and butter are cheap and good, but imported groceries are very dear, owing to tariffs (one pound of jam costs 2s 3d.) Owing to excessively high duties, the present cost of a bottle of whiskey is £5! Gin, etc., are correspondingly dear! Portuguese wines are good, and can be obtained cheaply.

Hotels. There are two at present, poor in type, but a new one containing twenty-four bedrooms, with a bathroom to each bedroom, and all the latest conveniences, is being built by the railway authorities.

The bathing is very good and most convenient; people bathe from their own doorsteps almost. It is said that although there are plenty of sharks they do not touch bathers, as there are so many fish in the Bay!

Sports and Games. There is no English Club, owing to the small number of English people, but private tennis courts exist, and constitute the only means of taking exercise. The shooting is excellent and plentiful —buffalo, lion, leopard, elephant and seven different kinds of antelope being obtainable within a fifty kilometres motor drive. The famous sable antelope is a denizen of the local forests.

The chief exports are beeswax, maize, cattle, sugar, hides and skins also copper and other minerals from the Belgian Congo.

Communications are fairly good. Ships of the German African Lines call monthly, also Portuguese and Belgian ships. In future, one Union-Castle ship is to call monthly on the outward voyage. Letters can be mailed home every twelve days.

The town is healthy on the whole. There is some malaria, but owing to the dryness of the soil there are not many mosquitoes. The malaria incidence inland is fairly heavy, and blackwater fever occurs in the country districts. The natives suffer from what appears to be a variety of veldt sore. A certain amount of dysentery occurs, and the jigger flea is said to be the cause of considerable annoyance to the European population.

Current Literature.

ADAMS, B. A. **Adsorption of Iodine by Activated Carbon in Water Treatment.** *Lancet*, 1932, i, 724.

This investigation was carried out at the Chemical Research Laboratory, Teddington, Middlesex.

Previous work with various waters regarding the association of iodine-content of a water supply with the prevalence of endemic goitre has shown that only a small loss of iodine occurs as a result of filtration. Chlorination of London water was found to have no effect on the iodine-content (Martindale and Westcott). On the other hand, Clark's process of softening carried out on Canterbury water brought about a reduction of 50 per cent of iodine.

Activated carbon is now being used extensively for the removal of taste and odour and for other purposes in water treatment. This substance is known to adsorb iodine and iodides from solution, and two series of experiments were undertaken in order to study its effect on aqueous solutions of iodine. Various forms of iodine were used in the experiments.

In one series of experiments 3,000 cubic centimetres of water containing two parts of iodine per 100 million were passed through a 40-cubic centimetre bed of carbon contained in a glass tube (1·5 centimetres diameter). In the other series, to a similar amount of solutions very finely divided carbon (approximately 0·5 part per 100,000) was added, stirred for a few minutes, and then filtered through sand. Two thousand cubic centimetres of the treated water were taken for the determination of the iodine, for which the sodium nitrite process of Martindale and Westcott was employed, with, in some instances, certain modifications, viz., the addition of potassium nitrate prior to incineration, to ensure the oxidation of the iodo-compounds in the presence of organic matter.

Both in distilled and Thames tap-water (M.W.B.), all forms of iodine were completely removed by treatment with activated carbon, either by passage through its granular form or by the addition of the powdered variety.

Although these results show the complete removal of certain forms of iodine, the author considers it desirable, before final conclusions can be drawn, that an investigation on the subject should be undertaken with a water supply actually being treated with activated carbon. Discrimination in the application of carbon in the treatment of water or replacement of iodine may be necessary.

Babecki, Lieutenant-Colonel Médecin W. J. **New Type of Barracks in Poland.** *Arch. Méd. Belges.* (*Jnl. Int. Cong. Mil. Med. and Phar.*), March, 1932.

The author of this paper also provides a summary in English. The following are the main points from this summary:—

Since the restoration of the Polish State the few barracks constructed have been modelled on those found in the West, chiefly in Germany. These are mostly buildings for two companies, or two battalions, with a corridor running the whole length of the building and with small dormitories for thirteen men. This type of building is considered inefficient and expensive. The division into small rooms is unsuitable from the point of view of army organization, such as inspection and control of inmates, extra accommodation, etc. Moreover, the corridor occupies nearly 30 per cent of available space, has other sanitary disadvantages, magnifies noises at night, shuts out sunlight, makes difficult the airing of rooms, and creates the possibility of the spread of infectious disease.

Plans for a new type of barracks have been drawn up which, with certain modifications, could be used anywhere. The system adopted was one of buildings without corridors, the dormitories each accommodating twenty-six men, with an additional six, or more, in case of necessity. Each barracks would house one battalion. Two companies would be accommodated on each floor, with separate washing and lavatory arrangements. There would be a lecture hall and also separate rooms for the use of troops. The advantage claimed for this method is that, if necessary, each company could be isolated.

The beds would be spaced from 60 to 80 centimetres, 1·25 metres from the walls, and 40 centimetres between the heads of the beds. Lockers would be provided for the men in the bed spaces.

On the ground floor, at a maximum depth of 1·5 metres, would be the kitchens (with fan ventilators), mess-rooms and rooms for washing eating-utensils.

Central heating would be provided.

It is considered that the central regimental kitchen has disadvantages from the sanitary standpoint, and epecially in cases of epidemics, such as influenza.

Green, Richard. **Malaria Treated with Atebrin, a New Synthetic Drug.** *Lancet*, 1932, ccxxii, 826.

Atebrin, previously known as erion, has been produced by the makers of plasmoquine, but its composition is not given. It is stated to be related chemically to plasmoquine, both drugs having a similar starting point—methylene blue.

The Institute of Medical Research, Kuala Lumpur, undertook an investigation regarding the efficacy of atebrin in the treatment of malaria. The drug was in the form of tablets, each containing 0·1 gramme of atebrin. The dose recommended was about one-sixth that of quinine.

Fifty cases of malaria (16 benign tertian, 24 sub-tertian, and 10 quartan) in male Tamils, Chinese and Sikhs, whose ages ranged from 6 to 50 years, completed seven days' treatment with atebrin. Forty-six similar cases were treated for seven days with quinine bihydrochloride, 30 grains daily, and were used in all similar respects for comparison with the atebrin-treated cases. The comparison consisted of the parasiticidal properties of the two drugs as ascertained from an examination of thick blood-films; comparison of the duration of the febrile period; relapses after treatment; action of quinine and atebrin on gametocytes; toxic symptoms; and notes on patients investigated and methods used. Full details and tables of results are given under these heads in the article.

The summary and conclusions of this interesting article are:—

That atebrin compares favourably with quinine in the destruction of malaria parasites in the blood and relieves symptoms, and that, so far, it seems superior to quinine in preventing relapses.

That the drug is not unpleasant to the taste, but in a few cases may give rise to abdominal pains. When large doses are used and excretion is delayed, a yellowish discoloration of the skin appears, which may remain for eight to fifteen days.

That atebrin, like quinine, does not rapidly affect the viability of gametocytes of *P. vivax* or *P. falciparum*, although over a period of seven days, or less, it destroys gametocytes of *P. vivax* sufficiently to prevent mosquitoes becoming infected from benign tertian cases within three or four days after treatment commences.

That the optimum dosage of the drug for all forms of malaria is probably 0·1 gramme per fifteen kilogrammes body-weight per diem over a period of six or seven days. Purgation should precede treatment, and the urine should be examined daily for the presence of the drug. Late appearance of atebrin in the urine indicates that the drug is accumulating in the body more than is desirable, and this may give rise to discoloration of the skin and scleræ.

That if the cost of atebrin is favourable, the drug is of importance, as it is shown definitely to be more effective than quinine in preventing relapses.

The author considers that atebrin deserves full and widespread investigation, but a final opinion regarding its general use in malaria and its toxicity should be withheld pending completion of such investigation.

NAPIER, L. E., BUTCHER, D., and DAS GUPTA, C. R. **Field Experiments with Atebrin and Plasmochin.** *Indian Med. Gaz.*, 1932, lxvii, 186.

The writers tested the action of atebrin and plasmochin in a boys' settlement six miles from Calcutta.

One hundred and eleven boys of all ages up to 15 years lived in the settlement and, from September 15, 1931, to January 31, 1932, 50 of the boys suffered from 61 attacks of malaria, 43 of which were *P. falciparum*

infections and 18 were due to *P. vivax*; in 3 of the *P. falciparum* cases *P. vivax* was also present. [In the colony 12 old cases of kala-azar were found, and of these 10 developed malaria during the period of observation.]

For three months plasmochin was given as a prophylactic measure to 46 boys, the dose being 0·01 gramme three times a week, boys under 12 receiving half that quantity. Twenty-six of these boys developed malaria, while only 24 of the 65 who did not receive prophylactic plasmochin developed the disease, and the writers consider that the small dose of plasmochin had a "provocative" action.

Forty-eight of the malaria cases—35 malignant tertian and 13 benign tertian—were treated with 0·1 gramme atebrin three times a day for four days in the case of boys over 12, and half that quantity for boys under 12, followed by 0·01 gramme plasmochin twice daily for three days, and half that quantity in the case of younger boys.

No other treatment was given to these cases, which were subsequently observed for two and a half months, during which there were seven clincal relapses, some of which the writers consider may have been fresh infections.

In forty-one cases the blood was examined immediately after the course of treatment, and in one malignant tertian patient only were a few parasites—crescents—found, but no asexual forms.

The writers conclude that in the relatively small and safe doses employed, atebrin exhibits a considerable degree of efficacy in the treatment of malaria.

WATSON-WILLIAMS, E. **Magnesium Sulphate in Otorrhœa.** *The Practitioner*, 1932, cxxviii, 556.

The author of this short paper condemns the use of peroxide of hydrogen in acute otitis, and states that it is as dangerous as syringing, which is seldom effective, may disseminate infection and cannot reach into the attic. It is remarked that in uncomplicated acute otitis media the ear heals whatever the treatment, or without any, and where it does not the reason may be a nasal or mastoid infection, general ill-health, or too drastic local treatment. Free escape of the discharge and scrupulous cleanliness are essentials when dealing with uncomplicated otorrhœa.

Magnesium sulphate is mildly bactericidal, yet non-irritating, and its principal action is by osmosis to promote the flushing of the ear with serum.

The method of treatment which has given the author good results, and which is applicable to all types of painless otorrhœa, is the following:—

The meatus of the ear must first be wiped dry with best quality wool, and it may need a dozen or more mops to ensure the meatus being quite dry. Most laymen need to be instructed in this important part of the treatment. The ear is then filled with powdered exsiccated magnesium sulphate. A piece of wool is then placed in the bowl of the concha and entrance of the meatus, *not* down the latter, and it is changed as soon as

it becomes wet. This treatment may require to be repeated two or three times a day; when the discharge becomes less, once a day is sufficient; when dry, treatment should be stopped. The patient should be warned to avoid application of water or "drops" to the ear.

In acute otitis media the treatment can be used as soon as the membrane is incised or ruptures.

The author does not suggest that his method will obviate the need for treatment of adenoids, rhinitis and sinusitis, and if after one month there is no real improvement, further examination should be considered.

Advantages claimed by the author for his treatment are that it is extremely simple, needs no special apparatus or experience, is safe, avoids need for syringing, is painless and is cheap.

CROWTHER, DAVID. **Bacteria Destroyed by Change of Pressure.** *The Mil. Surgeon*, 1932, lxx, 407.

This note, which is summarized from *Industrial and Engineering Chemistry*, x, No. 4, states that if bacteria are saturated with carbon dioxide at a pressure of 800 pounds per square inch, and that pressure is suddenly released, they are destroyed and the protoplasm of the cells is liberated in a colloidal form, owing to the sudden expansion of the gas within the bacteria.

Large quantities of vaccine have been made, but the process is still in the experimental stage.

Spores are not destroyed at the pressure indicated, and yeast cells are destroyed with difficulty.

Carbon dioxide is used in preference to hydrogen or nitrogen owing to greater solubility at room temperature, and the time required for its diffusion into the bacteria varies from one and a half to two and a half hours. A concentrated liquid suspension of bacteria requires no special treatment.

It is claimed that with certain bacteria the process ensures a superior vaccine to that in which heat is used, and that the pressure liberates the protoplasm of the bacteria without chemical change.

The process is also applicable to food, such as flour and cereals, for the destruction of weevils, eggs, etc.

Reviews.

THE CAUSE OF CANCER. By W. E. Gye, M.D., and W. J. Purdy, M.B London: Cassell and Co., Ltd. 1931. Pp. xiv. + 515. Price 30s. net.

This important book is recommended not only because it contains much thoughtful writing upon a subject concerning which more light is so urgently needed, but also because it is an account of a research which is a model of true scientific investigation.

There is little need to discuss the authors' views on the causation of neoplastic disease, for they are well known to all interested in the subject since the senior author first published his theory in 1925. As a result of a thorough revision of the earlier work these views have undergone a slight modification. Briefly, they may be stated thus: "Cancer is a cell reaction to a living intracellular virus, the reaction manifesting itself in cell growth and multiplication."

The book opens with a very fair review of the "cell-theory" of the causation of cancer, and is followed by a description of the work of Rous and others on the filterable fowl tumours. The greater part of the work, nearly 400 pages, however, is devoted to an account of the authors' experimental work at Mill Hill with these filterable tumours.

It must be obvious to all that one of the chief difficulties in obtaining experimental evidence as to the causation of cancer lies in devising such experiments as will be relevant to the solution of this problem. One's admiration is all the greater, therefore, for the carefully-arranged experiments and controls that are described in this section. The failures are recorded with the successes. Each experiment is fully described and is also summarized in beautifully clear chart form. The authors make no extravagant claims, and even if they are not able to bring forward direct evidence to prove that cancer is due to a filterable virus, their results are much more than merely suggestive.

The book represents an enormous amount of thought, ingenuity and patient laboratory work of the highest order, and although one may regret the record of such a research in this form, it cannot detract from its true value. The work remains one of the most important investigations of recent years. H. J. B.

CLINICAL OBSERVATIONS ON THE SURGICAL PATHOLOGY OF BONE. By David M. Greig, M.B., F.R.C.S.(Ed.), F.R.S.E. Edinburgh: Oliver and Boyd. 1931. Pp. xi. + 248, with 224 illustrations. Price 30s. net.

This monograph opens with a very clear account of the physiology and general pathology of bone. This subject is not treated, as a rule, very adequately in textbooks and is one that is usually not very attractive to

students. In consequence bone tends to be regarded as a special tissue subject to laws of its own. It is, therefore, very gratifying to find the author insisting that, as a first principle, osseous tissue should be regarded in the same light as other tissues. Only by such recognition can we understand the reactions that take place in bone as the result of injury, whether due to mechanical, toxic or organismal influences.

The author proceeds to describe various pathological conditions of bone which he illustrates by means of either dry museum specimens or recent clinical cases. The completeness and clearness of the descriptions and the excellence of the reproductions cannot fail to be of absorbing interest to the reader. A book that can be highly recommended. H. J. B.

A SUMMARY OF THE STRATEGY AND TACTICS OF THE EGYPT AND PALESTINE CAMPAIGN, WITH DETAILS OF THE 1917-18 OPERATIONS ILLUSTRATING THE PRINCIPLES OF WAR. By A. Kearsey, D.S.O., O.B.E., *p.s.c.*, late Lieut.-Colonel, General Staff. Aldershot: Gale and Polden, Ltd. 1931. Pp. 183. Price 3s. net.

This small book has been specially written for the promotion examination on military history for March, 1933. It is now in its second edition and is evidently popular with officers preparing themselves for this examination. It is well and clearly printed and gives a very good summary of the campaign.

There are twelve excellent maps. A. C. H. G.

SANITARY LAW IN QUESTION AND ANSWER. FOR THE USE OF STUDENTS OF PUBLIC HEALTH. By Charles Porter, M.D., B.Sc., M.R.C.P.Ed., and James Fenton, M.D., D.P.H. London: H. K. Lewis and Co., Ltd. 1932. Pp. xvi + 220. Price 7s. 6d.

The third edition of Sanitary Law in Question and Answer, by Porter and Fenton, brings this most useful little work up to date. It is of value not only to the student of public health, who will find all the essential laws relating to that subject clearly explained, but also to medical officers of health, sanitary inspectors and health workers, who can look up any point of interest with the minimum of trouble.

The book is of handy size, clearly printed and well got up generally.

N. L.

RESEARCHES PUBLISHED FROM THE WARDS AND LABORATORIES OF THE LONDON HOSPITAL DURING 1931. Selected and issued by the Publications Committee. London: H. K. Lewis and Co., Ltd. Price 7s. 6d. net.

This volume presents reprints of thirty-three papers by members of the staff and by research workers in the London Hospital which have appeared in various journals during 1931.

The papers include researches in medicine, surgery, physiology, pathology, bacteriology, immunology and biochemistry.

There are three papers on tumour immunity by Dr. T. Lumsden. A simple clinical method of estimation of protein in the urine and cerebrospinal fluid is described by Dr. Phyllis Tookey Kerridge. Mr. Cairns and Dr. G. Riddoch describe two cases of ependymal glioma of the spinal cord in which removal of the tumours led to recovery. Dr. J. O. Bland carried out further experiments on "experimental glandular fever" in the rabbit and concludes, from experiments with rabbits and monkeys, that the causal organism is a protozoon of the genus Toxoplasma, and suggests that human glandular fever may be caused by this organism. Hyperparathyroidism and general osteitis fibrosa are discussed in two papers, one by Dr. Donald Hunter and the other by Dr. Hunter and Professor Turnbull.

Report of the Librarian of Congress, U.S.A., 1931. Washington: United States Government Printing Office. 1931. Pp. xviii + 463.

We have received the report of the Librarian of Congress for the year ending June 30, 1931, which gives a detailed summary of the activities of the Library during the year.

The Librarian states in his Introduction that a new responsibility had been imposed on the Library by an Act of Congress in May, 1930, which authorized the annual appropriation of 100,000 dollars for the provision of books for the use of the adult blind; these books to be distributed by the Librarian to other libraries in the United States. It is of interest to note that it is specified in the Act that in the lending of these books preference will be given to the needs of "blind persons who have been honourably discharged from the United States military or naval service."

The chiefs of the various divisions of the Library summarize the work carried on in their divisions during the year and give details of some of the more interesting books, manuscripts, etc., added during the year, illustrations of some of these additions being reproduced.

Amongst the additions in the Division of Chinese and Japanese Literature there are notes on a Chinese work in seven books on colds and chills, issued probably in the 14th century and originally written in the 13th century; also an ancient work in eighteen books on smallpox, including a supplement on inoculation for smallpox, which is said to have been used in China for over a thousand years

Annual Report of the Surgeon-General of the Public Health Service of the United States, 1931. Washington: Government Printing Office. Pp. vii + 354. Price 85 cents, cloth.

This report of the Public Health Service of the United States for the year ended June, 1931, is the sixtieth annual report issued.

There are eight main divisions of the Service, each in charge of an Assistant Surgeon-General. These divisions are: (1) Scientific Research.

(2) Domestic (inter-State) Quarantine. (3) Foreign and Insular Quarantine and Immigration. (4) Sanitary Reports and Statistics. (5) Marine Hospitals and Relief. (6) Venereal Diseases. (7) Mental Hygiene. (8) Personnel and Accounts.

The volume deals not only with health conditions in the United States, but with those in other parts of the world which may have a bearing on the possibility of the introduction of diseases into the United States.

The activities of the Service, denoted by the mass of statistics, etc., published in this report, are manifold, and one merely touches the fringe in noting the statements that in 1930 the United States reported more cases of smallpox than did any single country, with the exception of British India; that the tuberculosis and diphtheria death-rates were the lowest ever recorded; that the incidence of influenza was unusually low; that there was a decrease in meningococcus meningitis; and that infantile paralysis was more prevalent. It is observed that more than 1,450 cases of undulant fever were reported and that the disease has been recognized in every State in the Union.

The prevention of the introduction of diseases from abroad, the medical examination of immigrants and the prevention of the spread of contagious and infectious diseases in inter-State commerce are dealt with very fully. The thoroughness of the work done by the immigration authorities is indicated in the statement that no instance occurred of the importation from abroad of any quarantinable disease into the United States.

Public health problems—cancer, leprosy, mosquito control, malaria and its transmission in the treatment of paresis, nutrition, tick-borne disease, industrial diseases, etc.—are dealt with at length. It is interesting to learn that further studies are being made on the discovery made during the year, that fleas may serve as vectors of typhus fever.

Venereal diseases continue to exceed the number of cases reported during the year of any other single communicable disease, except measles. In forty-three States there were reported 227,470 cases of syphilis, 154,809 cases of gonorrhœa and 3,987 cases of chancroid. Increasing importance is attached to the early diagnosis and treatment of syphilis. Syphilis was specially studied among negroes in rural areas. Of a total of 28,195 cases serologically tested, 5,785, or 20·5 per cent., were found positive in the primary survey. Seventy-five per cent. of these were treated intravenously, and at the end of the year forty-five per cent. of them were considered to be non-infectious.

The amount of work done by the Public Health Service in co-operation with other public health agencies is enormous; fifty-eight instances of such co-operation are given.

It is necessary to read the volume to realize the vast amount of work undertaken by the Service.

The report can be purchased from the Superintendent of Documents, Washington, D.C.

Notices.

IODIZED "MOOGROL."

IODIZED "MOOGROL" for the treatment of leprosy is a mixture of esters of the acids of the chalmoogric series combined with 0·5 per cent of iodine. The addition of the iodine is said to reduce markedly the irritating properties of the ethyl esters. Preliminary clinical experience confirms that Iodized "Moogrol" is less irritating than plain "Moogrol."

At the Leonard Wood Memorial Conference on Leprosy, held at Manila in January, 1931, the use of iodized esters, particularly by the intradermal method, was strongly recommended. The intradermal or intracutaneous method has been employed by the Philippine workers for some years and the advantages claimed are that it produces a more rapid resolution of the superficial lesions and that it is relatively free from general and local reactions.

Iodized "Moogrol" is issued by Burroughs Wellcome and Co. in bottles of 25 c.c., 100 c.c., and 1 litre.

"GUIDE TO CAERLLEON-ON-USK."

LIEUTENANT-COLONEL W. A. MORRIS, R.A.M.C. (Ret.), the author of this Guide to historic Caerlleon, informs us that he will help any officer of the Corps who intends to pay a visit to this district. His address is Caerlleon, Monmouthshire.

The booklet is admirably arranged in the form of ten chapters, each describing a different excursion, and should be of much interest to the student of archæology. It can be obtained, price 1s., from the *Express* Offices, Brecon.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, Journal of the Royal Army Medical Corps, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the Journal of the Royal Army Medical Corps is £1 payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

Communications in regard to subscriptions, change of address, etc., should be addressed "The Manager, Journal of the Royal Army Medical Corps, A.M.D.2, War Office, Whitehall, London, S.W. 1."

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Journal

of the

Royal Army Medical Corps.

Obituary.

LIEUTENANT-GENERAL SIR CHARLES BURTCHAELL, K.C.B., C.M.G., LL.D., F.R.C.S.I.

The sudden death of Sir Charles Burtchaell in the Queen Alexandra Military Hospital, Millbank, came as a great shock to his many friends, and especially to those who had served with him on the North-West Frontier of India, in South Africa and during the Great War.

Sir Charles Burtchaell had an outstanding personality and displayed great independence of character. He was big, both physically and mentally, and was well known throughout the Army, in which he had hosts of friends. Quite early in his service he gave much promise of achieving distinction as an administrator, and later became not only a complete master of the organization, administration and duties of the Corps of which he was such a distinguished member, but he acquired an extraordinary wide knowledge of the duties of all the other branches of the Army, especially where they became associated with the work of the Royal Army Medical Corps; this knowledge made a great impression on the General Officers Commanding under whom he served, and on the various Commissions before which he gave evidence in the course of his service.

Sir Charles had no bent for scientific investigation, but he realized the great influence that scientific work might have on the health of the Army and on the preservation of man power during war. He did all he could to advance the practice of anti-typhoid inoculation of the troops, and was always helpful in getting the Staff to adopt the most recent hygienic measures.

Charles Henry Burtchaell was born in August, 1866, the son of Mr. Peter Burtchaell, of Brandondale, Co. Kilkenny. He graduated at Trinity College, Dublin, in arts and medicine, and joined the Army as a Surgeon-Captain on July 28, 1891.

After a short service at home he proceeded to India, where he took part in the operations on the North-West Frontier in 1897-8. He was present at the actions of Chagru Kotal and Dargai; the capture of the Samphaga and Arhanga passes; the reconnaissance of the Sarau Sai and action of November 1897; the operations in the Waran Valley and action of November 16, 1897; and the operations in the Bara Valley, December 7-14, 1897.

For his services he was mentioned in Dispatches, *London Gazette*, April 5, 1898, and was specially promoted to the rank of Surgeon-Major. This promotion was of great importance to him, as he obtained field rank with only seven years' service.

Burtchaell's next active service was in South Africa, from 1899 to 1902. He was with the force which advanced on Kimberley, and was present at the actions of Belmont, Enslein, Modder River and Magersfontein. He took part in the operations in the Orange Free State from February to May, 1900; the operations in the Transvaal, west of Pretoria, July to November, 1900; operations in the Orange River Colony, May to June, 1900, including the action at Lindley. He was again mentioned in Dispatches and received the Queen's medal with four clasps and the King's medal with two clasps.

In August, 1902, he was seconded for service as Principal Medical Officer of the South African Constabulary, and retained this appointment until 1905.

In 1906 he was promoted Lieutenant-Colonel in the Royal Army Medical Corps.

In June, 1910, Burtchaell was appointed Assistant Director-General at the War Office, and was specially concerned with the personnel of the Corps, both officers and men. At the outbreak of war in 1914, this work became of enormous importance. The War Office was besieged by applicants for commissions in the Medical Service. Then came the selection and posting of officers to definite spheres of work in the Corps, and here Burtchaell's knowledge of men was of enormous value. It was remarkable how few mistakes were made, and how smoothly the war machine began to work. Selections for the appointments to the first divisions and for the lines of communication of the Expeditionary Force had already been made, but after the Force had sailed the staffing of the Kitchener Armies had to be undertaken; Burtchaell worked day and night, and only those then employed in the War Office had any idea of the mental and physical strain which the successful equipping of the New Armies involved.

On December 17, 1914, Burtchaell went to France as Staff Officer to Sir Arthur Sloggett, who had been appointed Director of Medical Services

of the Force in France. At Headquarters in St. Omer, Burtchaell soon made his influence felt, and in January, 1915, he was appointed Assistant Director of Medical Services, and promoted to the rank of Colonel. For three years he was the right hand man of the Director of Medical Services, and was promoted Major-General for his admirable work.

On the retirement of Sir Arthur Sloggett in May, 1918, Major-General Burtchaell was appointed Director-General of the British Armies in France, and made a temporary Lieutenant-General.

His extensive knowledge of administration and organization, not only of the Army Medical Service, but of the Army as a whole, was now brought into play. He had to control all the medical arrangements for the series of battles in which the British Armies were engaged in 1918, and for the final advance to the Rhine.

After the armistice was declared, the problem of demobilization had to be faced. Some two million men had to be brought home, and their clothing and equipment had to be disinfected before they could be landed in England. How well this work was done is now a matter of history.

In March, 1919, Major-General Burtchaell left France, and in June 1919, was specially promoted Lieutenant-General for distinguished service in connection with military operations in France and Flanders.

In 1919 the Government of India asked for a senior officer, well acquainted with the working of the Medical Services in France during the Great War, for the appointment of Director of Medical Services in India. General Burtchaell (now Sir Charles Burtchaell) was selected, and arrived in India just after the rebellion in the Punjab and while the war in Afghanistan was still in progress. At that time demobilization of British medical war units was being carried out and conditions were chaotic. General Burtchaell tackled the various problems with his usual energy and soon brought about a more settled state of affairs. Towards the end of the year trouble arose in Waziristan necessitating the employment of the largest force ever engaged in that district. The medical arrangements for the Waziristan Force were far in advance of any hitherto seen on the Frontier and earned unstinted praise from the Government of India.

Three years of strenuous work followed, during which Sir Charles obtained authority for the permanent employment of N.C.O.'s and men of the Corps in India, and for the increase of the Nursing Service to nearly four times the pre-war establishment. During these trying years he never spared himself, and many of his tours of inspection were carried out during the hottest months of the year so that he might have personal knowledge of the conditions under which the troops lived.

Sir Charles Burtchaell remained in India until his retirement from the Army in 1923.

For his services in the Great War Sir Charles Burtchaell was mentioned in Dispatches ten times, created C.M.G. in 1915, C.B. in 1917 and K.C.B. in 1919.

In 1925 he was appointed Colonel-Commandant of the Royal Army Medical Corps, and in the same year received a good service reward.

He received the American Distinguished Service Medal; the Belgian Order of the Crown, 2nd Class; the Belgian War Cross; the Legion of Honour, 3rd and 4th Classes; the French War Cross; the 1914 Medal with Clasp; British War Medal; the Victory Medal; and the Medal with Clasp for the operations in Afghanistan in 1919.

His distinguished services were recognized by his old University, who conferred on him the honorary degree of LL.D., and also by the Royal College of Surgeons, Ireland, of which he was made an honorary fellow.

Sir Charles Burtchaell married Bertha Marcella, daughter of Mr. J. G. Auret, of Johannesburg, and had two daughters.

The funeral service was held in the Chapel of the Queen Alexandra Military Hospital, Millbank.

The Duke of Connaught was represented by Major-General W. R. Blackwell. The pall-bearers were: Major-General Ensor, Major-General Ainsworth, Major-General Henderson, Major-General Hime, Major-General Sir George Stanistreet, Major-General O. L. Robinson, Colonel Gray and Colonel Purser.

Many officers of the Corps were present, including Sir William Donovan, Sir Thomas Gallwey, Sir George Bourke and Sir Marcus O'Keefe. Sir John Rose Bradford and Sir George Makins represented the Consulting Physicians and Consulting Surgeons of the old Expeditionary Force. The Matron-in-chief, Q.A.I.M.N.S., was represented by Miss Williams, Matron, Queen Alexandra Military Hospital, Millbank.

Original Communications.

CONCERNING FIELD AMBULANCES.

By Colonel H. B. KELLY, D.S.O.

The field ambulances that proceeded to the European theatre of the Great War were organized and equipped as the result of experience gained in the South African War. During that campaign no field ambulances existed, the collection of wounded being carried out by bearer companies which evacuated to the field hospitals, each of these units being independent under its own commanding officer.

It was found that there was occasionally lack of liaison between the two; also that the title field hospital was a somewhat glorified term, this unit being really a hospital only in name. It was, therefore, decided to combine the bearer company and field hospital into one command under the designation of field ambulance.

This field ambulance was subdivided into a bearer division corresponding to the old bearer company, and a tent division corresponding to the old field hospital. It was also subdivided into three sections, each section being capable of independent action with its bearer subdivision and its tent subdivision.

The present field ambulance is the result of further experience gained during the Great War. It is interesting to study the changes that have been made:—

(1) *Modifications in Equipment.*—This will not be dealt with.

(2) *Addition of Motor Ambulances.*—This change took place in the early stages of the Great War, and in this connection it is interesting to note that for years before the War medical officers taking part in medical staff rides urged the necessity for these vehicles. It has been suggested that expense was the bar. This was not the only reason; a strong counter argument was congestion of roads. The question of road congestion is always a big problem, and it was argued that every additional vehicle added to this difficulty, and where one vehicle could serve two purposes it must be used. Hence the well-known instruction "empty supply vehicles will assist in clearing the wounded."

(3) *Changes in Organization.*—If we study the organization of the present field ambulance does it not divide itself readily into a "light" and "heavy" echelon? How was it that during the long years of the War this very essential change was not introduced? Actually, for practical purposes, it was made by many field ambulance commanders modifying the method of packing.

Speaking for my own field ambulance, the necessity for this subdivision into a light and heavy echelon became early apparent, and so accordingly we drew up and printed a method of packing the whole unit.

For our light echelon we used our four general service limbered wagons. On two wagons was packed all that was essential to form two advanced dressing stations, and on the remaining two all that was essential to form one main dressing station. These, with the addition of our three water carts and ambulance wagons constituted our light echelon. We could send our forage cart and six general service wagons, the heavy echelon, to be brigaded in rear with the brigade second line transport. For all practical purposes we thus forestalled the tactical formation of the present field ambulance into a headquarters and two companies; the headquarters being capable of forming a main dressing station and each company an advanced dressing station.

Although all field ambulance transport was "first line" it was sometimes convenient for tactical purposes to brigade the heavy transport with the brigade second line.

These brief remarks, I hope, will demonstrate that the field ambulance as at present organized should be a convenient unit to handle tactically. The present formation has smoothed out difficulties which in the Great War had to be overcome by individual field ambulance commanders.

I have dealt with this subject broadly and have not touched on improvements in equipment, addition of a field cooker, etc., my object being merely to show how we have, so far as the organization of a field ambulance is concerned, profited by the lessons of the Great War. But have we profited in all respects?

I think we are in danger of forgetting many little practical lessons which may be worth while remembering, and the real object of this article is to record them. The events of the European war are indelibly impressed on the minds of all who took part in it, and we are apt to forget that the years are passing and a new generation is springing up completely ignorant of matters we feel we can never forget.

It was with such thoughts in my mind that some years ago when serving at Woolwich I volunteered to give some lectures as part of the winter training programme; one lecture was entitled "A few small points concerning field ambulance work." Several officers at the time asked me to publish the lecture; I attempt to do so now.

I will take up various situations in which a field ambulance commander may find himself, and deal with them seriatim. I may say at once that I am not dealing with tactics, choice of sites, requirements of A.D.Ss. and M.D.Ss. These subjects have been fully dealt with by Major-General H. Ensor, C.B., in the April, May and June numbers of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, 1924, and in the February number, 1931.

Situation No. 1. Mobilizing.

The assembly of the personnel and the drawing of the equipment and vehicles are done "according to plan."

The equipment may be drawn ready for use or crated for a journey. In the former case you will probably travel with loaded vehicles; in the latter, equipment and vehicles will travel independently. In the former case, if you have a few days before moving, immediately check your equipment in detail. In the latter case your first opportunity of checking will be on arrival in a concentration area. In both cases, if necessary, render immediately a "discrepancy return," i.e., surpluses or deficiencies.

How can the time after mobilization is complete, and before moving, be most profitably spent? In my opinion by a route march; then halt and unpack and lay out an imaginary main dressing station, disengage and despatch your two companies to form advance dressing stations. Practise intercommunication between M.D.Ss. and A.D.Ss.

Remember the essentials of a lay-out of a main dressing station are a large receiving room, with stretchers and blankets at the entrance for exchange with your motor ambulances, leading to a dressing room, and a resuscitation room leading to an evacuation room, and separate arrangements for gas casualties. If evacuation is not as rapid as reception, wards will be required for cases awaiting evacuation. Make arrangements for clerical work and for the supply of hot tea and sandwiches. These are the primary essentials and can be practised in any field, pegging out the floor spaces.

Practise loading; reduce this to a drill if possible.

Situation No. 2. Entraining.

During the mobilization period you should have prepared your vehicles for entrainment. Remember that the horsed ambulance wagons must entrain with their hoods telescoped, therefore see that you march to the station with hoods all ready: that poles of all vehicles must be dismantled, and swingle-trees of G.S. limbered wagons wired on. Remember that three axles usually go on each truck; therefore march your transport accordingly.

Remember that the vehicles are all new, and that all bolts, nuts, etc., must be freed and greased. Troops entrain eight to a carriage under N.C.Os., and must be drawn up at the station accordingly. Detail two guards, station them fore and aft of the train with instructions to get out on opposite sides at all halts, and see that troops do not leave the train.

If you are proceeding to a port of embarkation for overseas the personnel will require their sea kit-bags with them. See that each man is in possession of his sea kit-bag before he entrains. On no account allow sea kit-bags to be loaded as baggage, it causes much confusion and delay on reaching the embarkation station.

A small loading party will be required for loading vehicles. Horses must be entrained with their head-collars on and nose-bags available;

watering buckets and the necessary ropes to fasten across trucks to which ropes of head-collars are attached, must be ready. Grooms travel two to each horse truck. The railway staff are always responsible for making vehicles fast after loading on trucks. The height of a load must not exceed nine feet from the ground.

SITUATION NO. 3. EMBARKING.

On arrival at the port of embarkation you will be asked to fall in your men in messes of eighteen under a corporal. It is therefore well to have these groups already detailed and to give friends an opportunity of travelling together. These messes of eighteen are in accordance with Transport Regulations, that a ship's mess table must not exceed fifteen feet long and seat not more than eighteen men.

Train-unloading and ship-loading parties will be required and should be ready detailed.

SITUATION NO. 4. THE VOYAGE.

Take the opportunity of instructing all ranks in their duties. I recommend a detailed study of an article written by Captain (now Lieutenant-Colonel G. A. Collier), R.A.M.C., in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS in 1926, on movements of troops by sea.

SITUATION NO. 5. DISEMBARKING.

After disembarkation you may possibly be joining up with a brigade in a concentration area, ready to function as a field ambulance clearing sick, or you may be disembarking as an independent unit. The orders for disembarkation will vary in accordance with the method of loading. The transport may have been slung on board loaded, as was done when proceeding to France, or loaded empty with ordnance and medical equipment crated and independent, as was done in the case of the Shanghai Defence Force. In the latter case your orders must be more detailed, especially as you are not likely to be the only unit on board. There is every opportunity of your equipment going astray. Remember the ship may be unloading from holds fore and aft, and you should detail at least three collecting parties for duty at the quayside, one for ordnance equipment, one for medical equipment and one for transport. Remember that the transport authorities usually start unloading as soon as they possibly can, and units are relied upon to collect their own baggage on the quay. This will not be done for you by a permanent embarkation staff such as you are accustomed to in routine peace-time trooping; you have to work out your own salvation and your disembarkation orders should be prepared in detail well in advance, and should be communicated to all concerned.

If any equipment or baggage is lost, dropped overboard, etc., your disembarkation orders will certainly be called for in evidence at the subsequent Court of Inquiry.

Situation No. 6. In a Concentration Area.

Your field ambulance will now be detailed to clear the casual sick probably of a brigade and such other units as may be allotted to you by the A.D.M.S., and this may be the first time you are actually functioning. The chief point is to arrange a definite hour morning and evening at which you will send your motor ambulance transport round the regimental aid posts of your units; otherwise you will receive a stream of messages throughout the day asking you to collect individual sick. Until things settle down regimental medical officers are always afraid sick may be left on their hands. Get in touch with the regimental medical officers at once and have a personal interview and explain your methods. There is a tendency in billets to talk about medical inspection rooms; see that the term regimental aid post is used and adhered to from the first day of mobilization.

Obtain the confidence of the regimental medical officers. It is a very curious fact that regimental medical officers seem apprehensive that the field ambulance may leave them "in the air," even as the field ambulances are sometimes apprehensive as to the whereabouts of the motor ambulance convoy and the nearest casualty clearing station.

Personal interviews at the earliest opportunity establish confidence all round.

Situation No. 7. Move from a Concentration Area.

This may be by train or by route march. In both cases as we are not discussing tactics we will assume that contact with the enemy is not expected. Entraining has already been dealt with, but there is one point to remember, if you are entraining as part of a brigade group, arrangements must be made to deal with accidents both in entraining and detraining.

I will deal with a move by road in some detail.

It is preferable and usual for field ambulances to accompany their brigades. The order will have been given for field ambulances to come under the orders of the brigade commander. The brigade should, and always did, send a "warning order" at the earliest possible moment; detailed orders to follow. This warning order gave you the chance of packing up and disposing of any sick not likely to be fit to travel.

The detailed orders included: (1) Time and place the billeting parties would meet the staff captain; (2) Time an officer would report to the brigade major to synchronize watches; (3) Time of passing the starting point; (4) The route and destination.

Remember the following points when drawing up your march orders: You must collect brigade sick one hour before starting; you must calculate the distance from where you are billeted to the starting point; remember you march one hundred yards a minute, and the time of passing the starting point is the time the head of the unit passes.

You are marching in two parties, personnel and horse transport on foot with brigade, mechanized transport to follow "in bounds." Leave an

officer with the mechanized transport and remember it is essential for him to know the route. Instruct him as to the time he must start; he can follow "in bounds" every hour, halting when he overtakes the column, or he can start so as to be timed to reach the destination at the same time as the main body, e.g., the march is twelve miles; main body takes four hours. Instruct the officer-in-charge mechanized transport to start three hours after main body and travelling 12 m.p.h. he arrives coincidently with the advance party of the field ambulance.

This is the most economical arrangement. While he is waiting to start this officer has ample time to clear any sick that may have been collected before the march.

An orderly medical officer and stretcher party should be detailed for the march. All men falling out should, as a standing order, fall out on the right of the road, if you are marching on the left. If possible they should be put into one of the horsed ambulances by the stretcher party without halting. If you must halt, pull out of the column to the right side, so as to not hold up the following traffic; that is the advantage of sick being always on the right hand side of the road.

Your horsed ambulance wagons may be full up half way through the march. Do not pre-arrange dumping places; you may, if you do, reach the first dumping place with no sick and be overloaded before you reach the second. In practice it was found better to leave an orderly in charge of groups of sick dumped from the horsed ambulance wagons as occasion demanded. The orderly attracted the attention of the motor ambulances passing on the *same route*.

The officer commanding a field ambulance is now provided with a motor car, which is most essential. On the march his place is with the main body, and for this he requires a horse.

Always instruct your billeting officer to meet you well outside the billeting area; this will save much confusion and enable you to clear the road quickly instead of halting and perhaps blocking the road while you are waiting to have the area pointed out to you.

If the march is at night and you come to a forked road, always send an officer to see that each vehicle of the unit takes the correct road; drivers go to sleep, and I have known a unit divide into two from neglect of this precaution.

Situation No. 8. Supply of Drugs and Dressings.

The field ambulance of the Great War contained in its mobilization equipment sufficient dressings for about 4,000 cases. At the taking of the Messines Ridge in 1917 my field ambulance, acting with the assistance of four tent subdivisions of the New Zealand field ambulances as one of the Corps main dressing stations, attended 5,000 cases in fifty-seven hours. From such figures it will be seen how important the question of replenishment becomes. We must not forget that owing to the stabilized condition

of the fighting we were always in close touch with the advanced depots of medical stores, but in open warfare we must be more self-dependent.

It was found possible by filling all ambulance wagon boxes and by constructing a box to fit under the orderlies' seat in all motor ambulances to increase our mobilization equipment by 3,000 dressings. I recommend this course as soon as possible. It is usual to allow one ½ ounce wool, one ½ yard gauze, and a bandage for each dressing; a practical point when you are told to deal with 10,000 casualties.

On a march of some days' duration it is annoying to receive large indents from regimental medical officers. You may have arrived late after a long march and again have to make an early start next morning, and to comply with these indents means much unpacking. To obviate this, we always impressed on regimental medical officers to fill up during quiet periods. We also fitted a large box, known as our travelling dispensary, which was carried in one of the horsed ambulances. We filled this box with dressings and tablets, and found this usually sufficed for a brigade march of four or five days and saved unpacking. It appears to me that one motor vehicle fitted as a travelling dispensary would be a luxurious but valuable addition to a field ambulance.

Situation No. 9. Intercommunication.

Communication between advanced dressing stations, main dressing station and A.D.M.S. is simple, as you have motor cycles, and all should work well. But the forward communication with regimental medical officers may be difficult. Remember the wide frontage that may be expected. The field ambulance commander has to keep in touch with the brigade units just as much as the brigadier; the former has to work out his own salvation; the latter has a staff of signallers with all their impedimenta.

When an engagement is expected, always attach at least one squad from your companies to each regimental aid post. The first casualty establishes communication with the advanced dressing station, and you relieve the mind of the regimental medical officer that he is not "in the air" so far as the field ambulance is concerned.

Train every bearer to bring in intelligent information, such as "three stretcher and six walking cases still remain at the R.A.P." Having a proper understanding with the regimental medical officers so that they know you are keeping in touch and doing all you can. The other side of the picture is: the regimental medical officer receives casualties; no field ambulance bearers are on the spot; regimental medical officer informs battalion commander, who signals brigade. Consternation is caused, and usually a message comes through that "all available" bearers are required. If possible, keep medical communication "within the family," and avoid that most unsatisfactory "all available" message. I know of no better channel than through the medium of the stretcher-bearers.

SITUATION No. 10. SUPPLY OF EXTRA STRETCHERS AND BLANKETS.

It is common knowledge that stretchers disappear in war in an astonishing manner. Every medical appreciation I have seen recommends that a divisional reserve of stretchers and blankets must be maintained. These extras are not available in the first instance, but later are collected from casualty clearing stations and ambulance trains, strictly speaking without authority and, "low be it spoken," usually by means more foul than fair. Should not this reserve be carried and definitely provided for? A three-ton lorry would carry, say, 150 stretchers and 150 blankets and might be under the orders of the A.D.M.S.

As regards the carriage of the authorized stretchers, the G.S. limbered wagons of the field ambulance companies are awkward for the carriage of stretchers, and Major G. G. Drummond, R.A.M.C., Adjutant 43rd Wessex Division, T.A., suggested that if the rear half of one G.S. limbered wagon was of the long pattern it would facilitate packing. I quite agree.

SITUATION No. 11. RECORDING CASUALTIES.

This, as far as a field ambulance is concerned, is a necessary evil. It is essential that the Divisional Commander be told at frequent intervals the numbers of casualties. It helps him to gauge the nature of the fighting and decide on the question of reinforcements. Remember punctuality overrules accuracy in furnishing this information.

The following system was successful in keeping records of 2,888 casualties which passed through my Corps main dressing station in the first sixteen hours of the taking of the Messines Ridge in 1917, already alluded to.

At the door of each receiving room was stationed a clerk who jotted down the number and unit of each case, walking or stretcher, as it passed; thus at any moment the numbers could be checked. Thousands of field medical cards (for recording casualties—A.F.W. 3118), in their envelopes, were prepared beforehand, with a buff slip gummed to the envelope by one *corner* of the *counterfoil*.

While the case was being dressed the field medical card and also the buff slip were filled in. When the case passed into the evacuating room the buff slip was torn off, leaving the counterfoil, and passed to the A. and D. Book clerk who entered all particulars in the A. and D. Book at his convenience.

When the case was loaded on an ambulance the counterfoil of the buff slip was torn off and passed to the A. and D. clerk as a sign that the case had been evacuated.

To sum up:—

Case 1.—If the clerk at the receiving room has recorded 200 cases, and the A. and D. clerk has 200 buff slips you will know that 200 cases have been admitted, are dressed and await evacuation.

Case 2.—If the clerk at the receiving room has recorded 200 cases and the A. and D. clerk has 200 buff slips plus 180 buff slip counterfoils you will know that 200 cases have been admitted and dressed; 180 evacuated and 20 await evacuation. The A. and D. clerk arranges his buff slips by units and the telegrams are made out quite easily, recording casualties by units. Further, a circle on the buff slip indicates lying cases, and a cross, walking, you thus get your classification into "lying" and "sitting."

This simple method, I found, stood the test of time, and a very searching test in the case of the 2,888 casualties referred to. I recommend it to those who may not have a better one of their own.

General.

Any remarks one may make concerning field ambulances leave a feeling of incompleteness, inasmuch as we are considering only one type of unit, i.e., one suitable for a country with good roads, which, speaking generally, means a civilized country. It is true that general principles may be the same, but one would like to see a standard "Pack Field Ambulance," suitable, say, for bush or mountain warfare, and a standard "Desert Field Ambulance" suitable, as its name implies, for desert warfare.

The history of the medical arrangements for expeditions off the beaten track is a history of improvisation. If there is no time for improvisation and material is not ready the results may be awkward.

The article by Major-General P. H. Henderson, D.S.O.,[1] on ambulance transport in different theatres of war, gives much food for reflection and impresses one with the incompleteness of any article concerning field ambulances which does not make some allusion to this subject.

Then there is the question of aeroplane ambulance transport. My view, shortly, is that the more civilized the country in which operations may be taking place, the less need there is for the latest and most up-to-date aeroplane ambulance method of evacuation. I cannot imagine that aeroplanes would have hastened the evacuation from my Corps main dressing station at Messines. On the other hand, in roadless mountainous countries such as Kurdistan we pass from the ridiculous to the sublime, and casualties which could not be evacuated by donkeys were evacuated by aeroplane.

It is in such countries, in my view, that evacuation of casualties by aeroplane ambulance transport is the method of election. A further argument in support of this view is that the more uncivilized the country and in all probability the enemy, the fewer are the casualties, and aeroplanes are better suited for dealing with small than with large numbers of wounded.

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[1] "Ambulance Transport in Undeveloped Countries." Journal of the Royal Army Medical Corps, 1931, vol. lvii, p. 401.

Conclusion.

I feel a short explanation is necessary to try to justify the detailed nature of this article. Doubtless without attention to detail a unit will, as I once heard Mr. Atkins say, get there somehow, but you will get there with the maximum of confusion. You must remember that you are in the first instance dealing with a unit in its infancy. Officers, N.C.O.'s and men are unknown to each other, and you have to stand the test of comparison with units whose everyday work for years as a formed body may have included what your unit may be doing for the first time in its life. If you do everything at first with the maximum lack of law and order you will establish a feeling of inferiority complex; conversely, if rigid attention to detail is enforced from the onset, a corresponding feeling of confidence and superiority complex, so important for morale and smooth working, is established. Any lessons I may have learned have been taught in the best and hardest school, the school of practical experience.

I endeavour to pass these lessons on to those who may not yet have had their opportunity.

FUNCTIONAL NERVOUS DISEASES IN THE ARMY.

By Major S. SMITH,

Royal Army Medical Corps.

(*Continued from p.* 95.)

Vertigo.

Vertigo is another common symptom amongst soldiers, and apart from the few cases due to such organic lesions as disseminated sclerosis, cerebral neurosyphilis, etc., is usually "functional" in origin. The ætiology of the so-called Ménière's syndrome is uncertain, but in the few cases I have seen, all officers, there has always been a very definite neurotic tendency.

Some of these cases of vertigo are extremely difficult to "place" and the true ætiology has been a matter of doubt.

The following case illustrates this difficulty :—

A corporal, formerly a musician, was first admitted to hospital for vertigo four years ago. Physical examination proved entirely negative, his Wassermann reaction was negative, and his ears were normal. He was discharged cured after a stay of eighty-seven days in hospital. Two years later he was again admitted for vertigo complicated by otitis externa; the vertigo appeared to respond to treatment to the affected ear and he was again discharged cured. He was admitted a third time in April (1931), complaining of sore throat, fever, vertigo, marked ataxia and Rombergism, and was again discharged to duty after thirteen days' treatment. He was readmitted in May for a recurrence of vertigo, ataxia, and headache. On this last occasion the only physical sign suggesting the possibility of organic disease was well-marked and sustained double ankle clonus; the plantar responses were flexor. He was unable to stand or walk with his eyes shut, falling immediately if made to do so; with his eyes open he was able, after a little time, to walk without a stick but with a markedly reeling and drunken type of gait.

The Wassermann reactions (blood and cerebrospinal fluid) have remained negative: there are no signs of cerebellar disease (beyond the ataxia), and his discs are normal; the ears havebeen examined by an aurist and hearing is 100 per cent. On this last occasion, three months after admission, there has been no improvement.

In view of the frequent remissions and the definitely organic type of ankle clonus, disseminated sclerosis is, I presume, the most likely diagnosis, but I have never been able to rid myself of the idea that the whole condition may be functional in origin.

Many consider vertigo to be a vasoneurosis closely allied to epilepsy, and

in certain cases inseparable from *petit mal.* Especially is this the case with those transient attacks labelled "faints."

Of one thing we can be certain, namely, that the common "fainting attack" of the young soldier has nothing whatever to do with the heart, a common superstition which it is difficult to eradicate even from the minds of medical men.

D.A.H. and Dyspepsia.

Amongst the minor neuroses D.A.H. and dyspepsia play an important part in military medical practice.

Apart from a trifling percentage of cases due to organic disease, both the above are well-recognized symptoms of anxiety, neurotic states or neurasthenia, and they frequently occur together or alternate in the same patient.

D.A.H. is, as we know, seen in its most typical form as the cardinal symptom of the condition described by Lewis as the "Effort Syndrome," or "Soldier's Heart." In these cases the heart is not primarily at fault but rather its nervous control, and the tachycardia, arrhythmia, etc., form only one group of symptoms in a condition of general nervous instability. These patients do not improve, in fact their condition deteriorates, as a result of a long stay in bed, they are apt, too, to become rapidly hospitalized. Return to duty, or invaliding is the usual alternative.

I have learned, as a result of experience, to treat these patients as somewhat of a luxury in a ward, and like most luxuries, they can be done without. In fact, D.A.H. is a diagnosis I seldom make nowadays. In some cases a little mild psychotherapy works wonders, but on the whole they are an intractable class. In certain cases in whom unhealthy tonsils have been present, tonsillectomy has appeared greatly to improve the condition.

Some cases are undoubtedly examples of mild hyperthyroidism, a common military disease.

One should never forget to remember the possibility of pulmonary tuberculosis as a possible cause of tachycardia.

All the functional arrhythmias, extra systoles, simple tachycardia, sinus arrhythmia, paroxysmal tachycardia, etc., tend to become aggravated by residence in a hill station, while cases of organic heart disease are, as a rule, but little influenced by moderate altitude. The reason for this is partly explained by the monotony of life, especially for "other ranks," in these hill stations.

Many cases of dyspepsia (so-called nervous dyspepsia), probably a high percentage, are also functional in origin. There is one intractable form of indigestion simulating gastric ulcer, which I have found to be especially common amongst regimental bandsmen, and which for some years I have called "bandsman's stomach."

These cases of bandsman's stomach are extremely intractable, they are not improved by, or may even grow worse under, any of the strict gastric

ulcer régimes in vogue. They often vomit several times a day and give a history of having done so for years without any notable loss of flesh ; although they are apt to be thin and of poor physique, they often suffer from marked hypochlorhydria or complete achylia, and they have a way of making a sudden and miraculous recovery when tired of hospital restrictions or when the subject of possible sick leave is broached.

This particular form of dyspepsia is as much a perquisite of the bandsman—it does not appear to matter what instrument he plays—although not of course entirely confined to him, as is duodenal ulcer (so-called serjeant's stomach) a commonplace amongst the more senior non-commissioned ranks.

Apart from the above-mentioned variety of nervous dyspepsia, I have found complete or almost complete achlorhydria much more common in this country (India) than the four per cent commonly accepted as the normal proportion for this condition.

It is difficult to say if this achlorhydria is due to an actual gastritis or is simply a symptom of neurasthenia; in a large number of cases it is undoubtedly the latter.

Functional Albuminuria.

Albuminuria which occurs as a transitory and inconstant phenomenon in many young soldiers without demonstrable renal or cardiac disease is often regarded as a functional disorder; probably also the alimentary glycosuria, which is apt to occur in somewhat older subjects, who over-eat and over-drink and lead sedentary lives, belongs to the same category. One must be careful, of course, to exclude the glycosuria associated with hyperthyroidism, also not uncommon in young soldiers.

Functional albuminuria is common in young soldiers, and is said to occur from time to time in from five to ten per cent of normal individuals. In many cases this albuminuria coincides with a heavy deposit of crystals in the urine, when it may be accompanied by transitory hæmaturia ; both albuminuria and hæmaturia may be due to the mechanical irritation of the kidney substance by the sharp edges and points of these crystals.

Enuresis.

Enuresis is another common Army complaint, especially in recruits during their probationary period at the depots, and in most cases is of course due to an underlying neurosis.

While I was at the Royal Herbert Hospital, Woolwich, a very complete set of tests was performed on these young subjects of enuresis, a special ward being set aside for their accommodation, to find out if any physical basis for the condition could be found.

The capacity of the bladder was measured ; the urinary tract was

carefully passed under review; and the sacral region was X-rayed for possible congenital abnormalities in the shape of spina-bifida.

These tests were on the whole negative; in a certain number a mild degree of spina-bifida occulta was found, but as this anomaly appears to be common in normal individuals little importance could be attached to its presence in these cases. In most cases the condition cleared up when the recruit became more in harmony with his surroundings.

One case of so-called enuresis had a tragic ending and warns us of the urgent necessity for care in diagnosing these functional conditions.

I was called to see a young soldier in the "enuresis" ward who had suddenly started intractable vomiting and was complaining of blurred vision. There was no history of previous kidney trouble but there was a previous admission for enuresis, during the course of which he was noted to have slight albuminuria, thought to be of functional origin.

On examination he was found to have a systolic blood-pressure of 250 millimetres of Hg, and there was well marked albuminuric retinitis. His urine contained albumin in quantity; his blood-urea was in the neighbourhood of 200 milligrammes per 100 cubic centimetres.

He died a few days later, and autopsy revealed far advanced congenital cystic disease of both kidneys. In this unfortunate case the frequency of chronic interstitial nephritis had been mistaken for enuresis; an excusable if tragic mistake.

Endocrine Disorders.

Many cases of tachycardia are associated with (not necessarily caused by) mild hyperthyroidism; both of which conditions may be due to an underlying anxiety neurosis or other disorder of the functional group.

Cases of hyperthyroidism and mild Graves' disease are especially common in this country (India). There is one class of individual (she rarely becomes a patient until the disease is far advanced), a certain type of officer's wife, peculiar, in my experience, to India. Anyone acquainted with "Station" life in this country must know the type of woman to whom I refer. As a class they are unstable to a degree; uncontrolled and uncontrollable; a perfect pest to those in authority; and often a constant source of anxiety to their long-suffering husbands.

It is a curious but notable fact that many of these women suffer from quite noticeable thyroid enlargement and exophthalmos.

One particular case, an officer's wife, and a remarkably perfect example of the above-mentioned category, sought my advice for palpitations and breathlessness. I found the poor woman to be suffering from advanced Graves' disease with marked auricular fibrillation, from the effects of which she has since died.

Whether we are dealing with a primary condition of hyperthyroidism with the neurosis as a secondary phenomenon, or vice versa, must for the present remain unanswered.

NEURASTHENIA.

Neurasthenia, in my experience, is common amongst all ranks and at all ages.

Most military medical writers agree that it is especially common amongst the officer class, and in their case is apt to be intractable and often complicated by psychasthenic symptoms. The relatively high proportion of neurasthenics amongst officer patients was also noted during the late war.

Neurasthenia is also common amongst clerks and other sedentary workers, especially when they approach the "idle forties."

The symptoms are much the same as are met with in civil practice, having regard to the age-period and station of life from which most of our patients are drawn.

Alcohol and syphilis in these days of an almost "dry" and moral Army are not common as causative factors and the Wassermann reaction is rarely positive; unlike the Navy in this respect, in which Service, according to Surgeon Rear-Admiral Meagher, twenty-five per cent of neurasthenics are early sufferers from general paralysis.

Amongst a host of symptoms, headache, irritability, lack of concentration, loss of interest in work and play, and sleeplessness have been especially common in my series.

Reynolds [10] has thus succinctly described the headache of neurasthenia: "Headache is exceedingly common and is constant when it occurs; it may be a feeling of weight on the vertex with dragging pains up the back of the neck, sometimes coming forward to the root of the nose or round to the temples, or is like a tight band round the head, or a tight skull-cap; sometimes the skull is very irritable, at others the pain is across the brows and behind the eyes. Sometimes the pain is as if inside the brain, which is described as 'stirred up' or 'screwed up,' as if something were moving in it; or at other times as if the head felt empty."

According to the same writer, hyperæsthesia of the alimentary tract, including soreness of the tongue without demonstrable lesion, is the cause of a host of symptoms from which neurasthenics suffer.

This soreness of the tongue is an important symptom in a country such as India, where sprue is common. Cases of sprue often exhibit neurasthenic symptoms. On the other hand, many neurasthenics with painful hyperæsthetic tongues are, I am convinced, wrongly treated, and for prolonged periods, as cases of sprue.

"The neurasthenic is conscious" writes Tanzi [11] "of his breathing, digesting, walking, and thinking. His organic sensations, which should occupy the last place in his consciousness, spring at once to the front. By a sort of unfortunate clairvoyance, visceral functions, the work of which should be done with indifference if not actually unconsciously, become painfully conspicuous."

This attitude of mind leads to an undue solicitude in the normal

working of the various bodily functions and breeds a state of anxiety, an anxiety neurosis, in fact; but this is very far from being the same thing as true hypochondria, in which the patient is not apprehensive lest he be suffering from some serious organic disease, because he is convinced of it, and no one can shake that conviction.

Hypochondria is, when firmly seated, a most intractable disease, and it has been suggested that, in view of the fixed delusional content of its main symptom and lack of response to all forms of treatment, psychotherapy included, it should be classed amongst the major psychoses rather than the psychoneuroses.

Asthma, angio-neurotic œdema, urticaria, and the other so-called vaso-neuroses, were at one time classed together as neurasthenic symptoms. Modern writers, however, are leaning more and more to the theory that some biochemical change, a metabolic dyscrasia, is responsible for many of these disorders, although there is undoubtedly a background of neurosis to most of them.

That many of the angio-neuroses may belong to the order of "conditioned reflexes," is an attractive hypothesis.

The diagnosis of neurasthenia is often a matter of considerable difficulty and only arrived at by a process of exclusion.

Oppenheim [12] mentions the following objective symptoms as of some diagnostic value, but is careful to state that one must not expect all of them or even the greater part to be present in every case.

(1) Exaggeration of tendon reflexes.

(2) Exaggeration of the mechanical excitability of muscles (and less often of the nerves).

(3) Abnormal excitability of the cardiac nervous system, palpitations, and other objective symptoms of cardiac neurasthenia. (This, of course, includes the effort "syndrome.")

(4) Vasomotor, secretory, and trophic disorders, and spastic and atonic conditions in the organs with non-striped muscles.

(5) Disorders of metabolism (alimentary glycosuria, etc.).

(6) Tremor, rapid and fibrillary.

Special difficulty may be encountered in the differential diagnosis of neurasthenia from the early psychoses, such as early dementia præcox or manic-depressive insanity. This difficulty should be overcome, however, if we remember that "even if he suffers from imperative ideas, the neurasthenic is never a sufferer from mental disease, because his consciousness remains unclouded and his personality intact" (Tanzi). This distinction is, I must admit, easier to transmit to paper than to observe when confronted with a case.

Farquhar Buzzard [13] apparently looks somewhat askance at neurasthenia as a clinical entity and classes most cases of nervous exhaustion sent to him as suffering either from anxiety neurosis or from manic-depressive psychosis. The distinction between these two is important,

for, as he points out, manic-depressives are apt to end their troubles by committing suicide.

During the war two types of nervous exhaustion were met with, each requiring its own treatment:—

(1) *Simple Exhaustion*.—In these cases there were rarely any psychic changes, nor was the patient neurasthenic in the ordinary meaning of the term; he was a more or less normal individual suffering from extreme physical and nervous exhaustion, the result of sleepless nights and harrowing experiences. Recovery usually took place in a few days amongst quiet surroundings, and no special treatment, physical or psychical, was required.

(2) *Neurasthenia* proper.—Usually accompanied by well-marked anxiety and psychasthenic symptoms; these were amongst the most intractable examples of psychoneurosis met with, and a relatively high proportion were invalided. It is an interesting fact that out of one large series of neurasthenics collected during the war, sixty per cent. suffered from some degree of exophthalmos.

In addition to its legitimate use as denoting a definite and well recognized disease entity, neurasthenia is also used, I regret to say, by many of us, as a convenient label for many of those border-line cases of mental disability, which, in our Sister Service, the R.A.F., are more correctly designated under such headings as anxiety neurosis, psychoneurosis, psychasthenia. This latter term is, for some reason, placed in the mental disease group in the Official Nomenclature, and cases thus diagnosed must be certified.

Most of us are loath to label a case insane unless we are moderately certain that his conduct, behaviour, and mental outlook on life are sufficiently asocial to justify such a course and that he would be a danger to himself or to others if no such precautions were taken.

I have discussed this matter with a mental specialist (military) of many years' standing, and he is frankly in favour of "playing for safety" and certifying all doubtful cases. He argues very rightly that certification in the Army is by no means the same thing as certification in civil life, and that no stigma of insanity attaches to the patient, who has been certified by us, on his final discharge. Be that as it may, I am not convinced that "no stigma" attaches to the patient thus certified; and, in any case, the knowledge that he has been at one time considered temporarily insane and certified as such, can do no good to a man suffering from severe anxiety neurosis, for example.

For this reason the diagnosis of neurasthenia is probably justified in many of these border-line cases until such time as the Official Nomenclature is revised and its scope in respect of the psychoneurotic group widened.

The Convulsive Group.

"Fits," like the poor, are always with us, and constitute one of the bugbears of the conscientious medical officer in charge of wards.

The fact that a man has had a fit is easily determined, although one often has to draw one's evidence from the garbled and highly coloured accounts of his room mates; to ascertain the nature and ætiology of the attack is quite another matter, and frequently impossible.

It is a curious and noteworthy fact that no matter how many fits a man may have prior to admission, during his period of observation in hospital, which may run into many months, he is frequently entirely free from them; he is returned to his unit after a period of observation diagnosed N.A.D., only to have another fit on the doorstep of the barrack room as he enters it, much to the secret joy of the regimental officers, who are apt to adopt the "I told you so" attitude, and straightway drive another mental nail into the wretched medical officer's coffin.

The reason for this is not far to seek. Probably some eighty to ninety per cent of all fits in soldiers are either hysterical or psychogenic in origin. The psychogenic individual "throws" a fit—genuine though it may be, epileptiform in character—to escape from the realities of an unpleasant situation, to wit, the discipline and irksomeness of barrack life, possibly with an unsympathetic N.C.O. thrown in. On admission to hospital, under the care of a sympathetic Sister, with little discipline, and far removed from the hated N.C.O., there is no further need for the fits and they stop, only to recur when he is returned to his former environmental difficulties.

This is not to say that these psychogenic fits are purely hysterical, although they are obviously psychogenic or functional in origin; the patient may lose consciousness, bite his tongue, strike his head, urinate, etc., during the course of the fit and yet not belong to the category of so-called essential or idiopathic epilepsy.

Kennedy [14] has recognized the importance of these psychogenic seizures when he writes: "It must be remembered, however, that during their first experience of a hot climate, if subjected to physical or mental stress and especially in association with over-indulgence in alcohol, young adults may exhibit fits of an epileptiform character (indistinguishable from true epilepsy) which never recur on return to this country (England). The disposal of such cases in which the diagnosis of epilepsy is open to doubt, is a matter requiring much consideration, and, for the reasons I have stated above, the diagnosis may be changed to hysteria and the man retained in the Service."

Although I am in full agreement with the main trend of Colonel Kennedy's argument, I do not consider that these psychogenic convulsive attacks should be classed as hysterical. Such symptoms as true loss of consciousness, *fixed* dilated pupils, tongue biting, incontinence, etc., clearly belong to the category known as "organic"; and, although one must admit that the former barriers raised between "organic" and "functional" are largely artificial, I would prefer to use some term other than hysteria to cover these psychogenic convulsive attacks, leaving the term hysteria to designate the purely hysterical seizure, characterized by much struggling,

pantomime, etc., and essentially unaccompanied by such phenomena as true loss of consciousness and fixed insensitive pupils.

Psychasthenia is probably a more apt diagnosis for the condition underlying these epileptiform attacks, but is objectionable in the present state of the Official Nomenclature which, as stated above, places psychasthenia amongst the mental diseases, which it is not.

Aldren Turner [15] has also accepted the theory of a purely psychogenic origin for some of these epileptiform attacks when he states: "To his mind there could be no doubt about the existence of a group (of epileptiform attacks) having a psychogenic origin. It was well known that emotional shock might lead to attacks in no way different from those of the so-called genuine epilepsy, and it had been contended that the psychogenic origin of a seizure should not be ignored because in the fit the patient had bitten his tongue or been incontinent."

The diagnosis between a hysterical and an epileptic convulsive attack may be very difficult and even impossible. It is open to doubt, in fact, if there is any essential difference between the two.

There are fits, we have all seen them, characterized by much pantomime, struggling, gesticulation, etc.; the eyes are usually kept tightly closed; there is often a squint due to spasm of one or other of the ocular muscles; and the pupils may be contracted or dilated, but *react* to light; the seizure may be followed by typical segmental anæsthesia of the stocking and glove or the unilateral variety. Fits or "struggling attacks" of this nature are of course easy to diagnose and constitute *la grande hystérie* of Charcot.

On the other hand, we have the habitual epileptic with his greasy skin, slow cerebration, etc., in whom the attacks recur at moderately regular intervals and often at night, and which are only to a very moderate degree influenced by external factors.[1]

In these attacks, the fit follows the classic sequence of aura, tonic followed by clonic spasms with unconsciousness, and often followed by post-epileptic phenomena.

This type of fully fledged epileptic seizure, the classic major attack, is relatively uncommon in the Army. The so-called incomplete epileptic attack, or one or other of the epileptic equivalents—the latter a dangerous and a sinister group, the full range and significance of which are as yet not fully appreciated being more common.

Between these two classic extremes, *la grande hystérie* of Charcot and the major epileptic seizure, there is a vast hinterland of incomplete seizures of doubtful ætiology: hystero-epilepsy; psychogenetic; epileptiform; call them what you will.

In this middle stratum lie the majority of fits so common in (or rather, out of) our wards.

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[1] It has been noted by those in charge of epileptic colonies that even amongst confirmed epileptics emotional and mental factors play an important part in the causation of the individual fits.

As suggested above, the majority of the victims of these attacks are individuals cursed by some inherent instability of character, who have been unable to make the necessary mental adjustment to their new environment.

If the environment can be so altered as to be more in sympathy with their outlook, and if the external or exogenous factors play a more important part in their causation than do the endogenous or personal factors of inherent defect of character, they may be cured by the removal of the unpleasant situation or experience, whatever it may be; or possibly taught to overcome it and thus rise superior to their environment instead of being dominated by it; on the other hand, if the personal factor looms large, especially if there is a bad heredity, the prognosis is so much the worse.

These psychogenic fits are apt to occur in infantry soldiers who have been detailed for transport duties which entail being in charge of mules or horses (which, on interrogation, it is found they are frightened of or unable to manage); or in cavalry or gunner recruits during their early riding-school days. In these cases the fits may often be brought to an abrupt end by transferring the transport driver to his former "foot-slogging" duties, or the cavalry recruit to an unmounted branch of the Service. A better method, of course, is to explain quietly to a patient the reason for his seizures, and to encourage him to overcome his repugnance for this, to him unpleasant, duty.

It is, of course, with something of the same idea that the pilot of an aeroplane, who has just crashed, is made to make another ascent forthwith to prevent the formation of a "phobia" for piloting aeroplanes; in other words, to prevent him from "losing his nerve."

Mention has been made already of the difficult and dangerous category of the epileptic equivalent. From a medico-legal standpoint we are here on debatable ground, and a diminishing few still deny their occurrence, and refuse to accept this plea as an excuse for crime, even if the individual is an epileptic and the crime has been shown to have been unpremeditated and committed for no apparent reason. Most neurologists and alienists agree, however, that certain of the unpremeditated crimes of violence, especially those with a grossly sexual basis, that figure so prominently in our newspapers of to-day, may be the result of epilepsy in one of its protean forms.

For the same reason, it is possible that certain of those individuals who, from time to time, are brought into our mental wards under guard, for observation as to the state of their minds, having committed some such crime as striking an officer or N.C.O., or committed a sexual assault, may be similarly afflicted. It behoves us, therefore, in all such cases, to make a careful inquiry as to a past history of fits or of fainting attacks (*petit mal*).

Unfortunately, the victims of this, as of other forms of epilepsy, are as a general rule perfectly normal between the attacks and may be, and often

are, discharged, with some such diagnosis as N.A.D., only to commit some more serious crime when once their liberty has been regained.

If only for this reason it is always advisable to have the "backing" of a second opinion (even if a Board be thought unnecessary), before discharging a case who had been admitted for observation on account of some peculiarity of conduct or behaviour.

Border-Line Cases.

The more aggravated types of psychoneurosis, the severe anxiety and compulsory neuroses, phobias, hypochondria, etc., as well as, of course, the definite psychoses, come more under the purview of the mental than of the medical specialist.

There is one form of psychosis which appears to be prevalent in our Army, and partly accounts for the high recovery rate from mental disease, namely, the so-called psychogenetic psychoses.

These cases constitute the mental equivalent, so to speak, of psychogenic epilepsy, a reference to which has already been made.

This psychosis, an eminently curable, or rather recoverable, condition in most cases, is apt to occur in individuals of marked mental instability who are suddenly confronted by overwhelming environmental difficulties to which they temporarily succumb, their downfall being exteriorized as a psychosis of a temporary nature, recovery taking place when the environment is changed, or, more rarely, when and if they can be made to overcome the difficulty without change of environment.

Major Webster [16], in an interesting article calls attention to the frequent occurrence of this form of psychosis in the Army and stresses the good prognosis in a high percentage of cases. He describes the salient features of a simple case in this group as follows:—

(1) The reaction of the patient to life is, in a general way, normal before the onset of the psychosis.

(2) The illness is directly the result of a difficult or disagreeable situation.

(3) The delusional content, if any, is related to the experience which caused it.

Most of us can, on reflection, I think, recall cases, puzzling at the time, which fulfil the above diagnostic criteria, and which, contrary to our expectation based on textbook accounts, have completely recovered.

The differential diagnosis between these psychogenic psychoses and dementia præcox may be extremely difficult and depends more on the lasting nature of the delusional content in the latter—especially if the delusions persist after removal of the patient from the surroundings or individuals which precipitated the psychosis—than on any essential difference between the symptoms of the two conditions. A bad family history naturally, and I think rightly, prejudices one in favour of the more serious condition.

To make the diagnosis even more difficult it must be remembered that

long remissions are by no means uncommon in dementia præcox during which it requires an expert alienist (or a member of his family in close daily contact with the patient) to recognize that there is anything mentally wrong with him.

In spite of the essential curability of many of these psychogenetic cases if removed from the provoking environment, Major Webster considers that they should be treated as temporarily insane—as indeed they are—and be invalided.

Regulations of course also demand this course, as no soldier is allowed to continue to serve if he has once shown signs of mental disease, even if he be completely cured.

There is one form of temporary psychosis which should, and in my practice does, form an exception to the above hard-and-fast rule—namely, the exhaustion of toxic psychoses, usually of confusional type, with little or no fixed delusional content. Examples of the toxic psychoses are not uncommon in India and are especially liable to follow prolonged fevers of the typhoid group. In my experience, the prognosis is uniformly good in these cases with no tendency to relapse, and they should not be invalided, except for a period of convalescence in England.

In spite of statements to the contrary malaria is not, in my experience, a cause of psychotic disease.

There is one possible exception to the generalization concerning the rarity of true and persistent mental disease in the Army. Sir Farquhar Buzzard has pointed out that manic-depressive psychosis is far more common than is generally believed.

A large number of chronic and incurable alcoholics are, he states, manic-depressives, and are alcoholics because they are manic-depressives ; he also mentions the important practical fact that most cases of suicide occur amongst the manic-depressive class.

This form of psychosis, a somewhat elusive one in the early stages with no very definite or characteristic symptoms, is apt to escape our notice if we are not on the look out for it; and partly for this reason is probably not commonly diagnosed in military practice, at least not before the case comes under the care of a mental specialist.

In view, therefore, of the likelihood of these patients ending their own lives—the only suggestive symptom being a state of mild depression—it behoves us to be specially careful in our disposal of these depressed patients.

Those individuals that have been sent into hospital, often under arrest, for observation on account of some peculiarity of conduct, or, as often happens, after some act of violence to a N.C.O., or for having beaten a native, are amongst the most difficult class of case to deal with. Their symptoms, if there be any on admission, usually clear up in a few days, and their disposal becomes a matter of difficulty and of anxiety.

My only comment is: Do not be rushed into a hasty and ill-considered

diagnosis, and an equally rash disposal of the case, by the importunity of the man's regimental officers. In most cases it is advisable to await the decision of the Medical Board which by regulations is bound to sit on all such cases after a month's observation in hospital. We are lucky, of course, if we have the services of a mental specialist at our disposal.

If, however, there is clearly nothing wrong with the man beyond the fact that the unit wish to rid themselves of an inefficient soldier and are attempting to do so by the comparatively easy method—to them—of a Medical Board—the man should be returned to his unit with the suggestion that he be got rid of under regimental arrangements if this be considered advisable in the interests of the Service.

A few cases of general paralysis are admitted to the mental wards each year, but this is a relatively rare diagnosis, and the Wassermann reaction—which should of course be taken in all cases showing mental symptoms—is consistently negative.

In this respect it must be pointed out that the presence of a positive Wassermann reaction in a patient showing symptoms of mental disability, does not necessarily mean that he is suffering from G.P.I. Syphilitic neurasthenia is a very real disease and is often accompanied by psychasthenic symptoms, especially of a hypochondriacal nature.

Treatment.

With regard to the treatment of the various psychoneurotics with their kaleidoscopic ailments who help to fill our wards, I am unable to make any authoritative or even very helpful statement.

In common with the majority of my medical colleagues of the older school, I have had little or no training in psychological methods of treatment, which were a trifle *démodé* when I was a student. In this respect, I would suggest, therefore, that medical specialists, at least, receive a grounding in psychotherapy (not necessarily in psycho-analysis, which has yet to prove its worth). Without this equipment one is sadly handicapped in dealing with this large and ever-increasing body of psychogenic disorders. Personally, I greatly feel the need of such expert knowledge.

It would appear that there are four main lines of psychotherapeutic attack:—

(1) *Suggestion or Persuasion.*—A method popularized by the French school and particularly successful in the treatment of the conversion neuroses (hysteria). This method has been further modernized by the "Coué" school of auto-suggestion.

(2) *Abreaction*, by which the patient is encouraged to "let out" the underlying emotion.

(3) *Re-education.*—The patient is encouraged to re-direct his energy from the more primitive to the more civilized form of reaction.

(4) *Psycho-analysis.*—The patient is encouraged to delve down into the recesses of his forgotten or subconscious childish memories for the

"psychic (sexual) trauma" underlying his present neurosis. Freud, the originator of the system, and his two former collaborators Jung and Adler, have each developed their own schools of psycho-analytical technique.[1]

All the above methods were exploited during the late war in the treatment of the war neuroses; and in evidence before the Government Shell Shock Committee witnesses expressed no very decided opinion as to which was the best; most witnesses were agreed, however, that anything like full psycho-analysis was too involved and laborious a proceeding for military war-time practice.

Whilst all the above lines of psychological treatment have their uses—in the hands of those with the necessary psychological equipment—in the treatment of specially selected cases, that of suggestion or persuasion is most generally useful and requires less specialized knowledge on the part of the operator. Psycho-analysis is time-absorbing and requires a special technique and mental equipment not possessed by many of us.

Re-educational methods have also claimed many successes when properly applied.

Conclusions.

In conclusion, some explanation is due for having included in my review certain conditions which might appear to lie outside the scope of the functional nervous disorders.

My excuse must be that the term "functional" as applied to a disease group is difficult to define, and probably, for the reasons given above, undefinable.

My endeavour has been to include only those conditions which are generally considered to be "psychic" rather than "physical" in origin; although there is still a body of expert opinion that considers that physical factors play an important part in their causation and perpetuation.

When it is realized that probably fifty per cent of our patients are to some extent psychoneurotic, and that nearly a hundred per cent suffer from some degree of anxiety neurosis in addition to their more tangible ailments, the importance of the group must be admitted.

Finally, I would call attention to the marked divergences of opinion (often amounting to flat contradiction) expressed as to the ætiology, diagnosis, nomenclature and treatment of the whole group of psychoneuroses by the leading neurologists and psychiatrists the whole world over.

While this is a healthy sign showing universal interest in the subject with its promise of progress, and shows that many active minds are intensively engaged on the many problems provided, it may truly be said that the whole subject is in a state of fluidity, and finality is very far from being reached.

[1] Strictly speaking Freud is the only one of the three who makes use of psycho-analysis; the methods used by Jung and Adler being psychological but not psycho-analytical.

Under such conditions it is difficult for the medical "man in the street" to know what lead to follow.

"*Mediis tranquillus in undis*" should, I think, be our motto, and we should endeavour to steer a safe and middle course between all the conflicting doctrines, taking care not to be unduly influenced by extremists on either side, until such time as the true worth of one or other of them has been fully proved, not only to the satisfaction of the doctrines, but to our own satisfaction as well.

There is one further point I would stress in conclusion. It is a notable fact that certain diseases are disproportionately prevalent in certain units—I could quote many instances—and usually a reason for this can be found; it is equally true that certain units furnish an undue proportion of psychoneurotics and border-line cases; and again there is usually a reason for this if we can only find it.

Disharmonies in regimental domestic life are just as prone to produce —or more accurately, provoke—a neurosis as are similar conditions in family life.

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RESULTS OF TREATMENT OF MALARIA BY (*a*) PLASMOQUINE AND QUININE, AND (*b*) ATEBRIN, TOGETHER WITH SOME OBSERVATIONS ON MALARIA CONVALESCENTS.

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I.—The Malaria Treatment Centre, Kasauli.

The observations recorded in this note were, for the greater part, embodied in the Annual Report of the Malaria Treatment Centre, Kasauli, for the year 1931, submitted to the D.M.S., India, and Lieutenant-Colonel H. H. A. Emerson, D.S.O., Deputy Director of Hygiene and Pathology, Army Headquarters, suggested that they might be of sufficient general interest to warrant publication in the Journal.

The main work of the Malaria Treatment Centre (M.T.C.) has been the attempt to discover, under controlled conditions, an effective and safe routine treatment for chronic relapsing cases of malaria. Kasauli stands a little over 6,000 feet above sea-level, and fresh infections can be almost certainly excluded; so that if a case relapses after completion of treatment, there can be little doubt that the treatment was not effective.

Cases of malaria (mostly chronic relapsing cases of benign tertian type), which have relapsed in spite of treatment in the plains, are sent to the M.T.C. from all over India, but year by year the cases so sent are gradually diminishing in number. The accommodation allotted is for 150 convalescents, but during 1931 there were only 126 arrivals, the greatest number present on any day being 69 and the smallest 18. From the point of view of numbers, therefore, the Centre is not being "supported" as well as it might be, though, doubtless, the military situation, the fact that 1930 was an unusually good malaria year, and the introduction of treatment by plasmoquine in combination with quinine in many of the larger stations in 1929, may have combined to reduce the supply of chronic relapsing cases of malaria.

II.—Routine of the Malaria Treatment Centre.

Malaria convalescents attending the M.T.C. are accommodated in the Hill Depot, Kasauli, and report at the Centre in the British Military Hospital on the morning after arrival, when they undergo a thorough medical examination, and a record is made of the (1) weight; (2) result of blood-smear for malaria parasites; (3) degree of splenic enlargement; (4) red blood-count; (5) hæmoglobin percentage; (6) white blood-count; (7) differential count; (8) blood-pressure; (9) pulse-rate.

They report on the same day each succeeding week, when (1), (2) and (3) are invariably recorded, while (4) to (9) are noted at regular intervals or

as deemed necessary. If parasites are found in the routine weekly smear, or at any time during the interval between weekly examinations in the event of a convalescent reporting sick with fever or other symptoms, the man is forthwith admitted to hospital and placed on one or other of the courses of treatment under test. (We do not accept the diagnosis of "Malaria, clinical.") He is kept in hospital for the full period of the course (fourteen to twenty-one days). After completion of treatment each case is observed for a further period of twelve weeks, and is then given a fourteen days' course of plasmoquine 0·01 gramme plus quinine ten grains twice daily, before being returned to his unit. A man who has not developed a relapse during his stay in Kasauli (usually twelve weeks) is likewise given the the same fourteen days' course before rejoining his unit.

Throughout his stay at the Centre, with the exception of any period of specific treatment, each convalescent is given an iron and arsenic tonic twice daily for fourteen days at a time, with seven days' interval between the courses.

III.—Relapses before Treatment.

Of the 126 convalescents who arrived at the Centre during 1931, only 53, i.e., 42·1 per cent. relapsed prior to the commencement of specific treatment. Table I is interesting as showing when the majority of relapses occur :—

TABLE I.

Percentage of Convalescents who Relapsed in the Various Weeks after Arrival.

Week ..	..	1	2	3	4	5	6	7	8	9	10	11	12	13
Relapses	..	41	15	13	7	6	6	—	2	4	2	—	2	2

The vast majority (eighty-eight per cent) of relapses thus occur in the first six weeks. (In an excellent report by Major S. Smith, R.A.M.C., in the files of this Centre, corresponding figures for 1928 are given in the case of seventy-five relapses, eighty-nine per cent of which occurred in the first six weeks ; so that there is an almost "uncanny" constancy in the figures.) It would appear, therefore, that we would be justified in taking eight weeks as a fair and practicable period of observation pending relapse. The majority were actually observed for at least twelve weeks, and, similarly, twelve weeks' freedom from relapse after completion of treatment was taken as the arbitrary standard of "cure."

Of the 53 relapses 51, i.e. 96 per cent, were benign tertian, and only 2, i.e. 4 per cent., malignant tertian. No case of quartan infection was encountered.

IV.—Treatment of Chronic Benign Tertian Relapses with Plasmoquine in Combination with Quinine.

The main investigation carried out during 1931 was the determination of the minimal effective dose of plasmoquine in combination with quinine in the treatment of chronic relapsing cases of benign tertian malaria.

In April, 1930, Major A. E. Richmond, O.B.E., R.A.M.C., then in charge of the Centre, started Treatment "C," which consisted of plasmoquine 0·02 gramme plus quinine grains 10 in the morning, and plasmoquine 0·01 gramme plus quinine grains 10 in the evening, a total of 0·03 gramme of plasmoquine and 20 grains of quinine daily, for twenty-one days. In his annual report for 1930 Richmond recorded 75 cases treated by this method, with 4 relapses, a relapse rate of 5·3 per cent. Two more of the 75, however, relapsed during 1931, giving a total of 6 relapses and a corrected relapse rate of 8·0 per cent.

During 1931 we treated a further series of thirty-one cases by the same method, and had no relapses during an average observation period of 12·7 weeks. Table II shows the actual number of weeks of observation in each case:—

TABLE II.

CASES TREATED BY TREATMENT "C" WITH NUMBER OF WEEKS OBSERVED.

	No. of cases		No. of weeks observed after completion of treatment
	1	..	9
	3	..	10
	1	..	11
	14	..	12
	4	..	13
	3	..	14
	2	..	15
	2	..	16
	1	..	20
Total	31	Average	12·7

It will be noticed that five of the cases were not observed for the full period of twelve weeks, at which we aimed as the standard of "cure." This was due to the necessity of repatriation to Great Britain of the men concerned on expiry of their terms of engagement.

The average period of observation after completion of Treatment "C" in the seventy-five cases treated in 1930, was 10·7 weeks.

Adding the two series together, there has been a total of 106 cases treated by Treatment "C," with six relapses, giving a relapse rate of 5·7 per cent.

This must be considered highly satisfactory, when it is remembered that, employing even less severe standards of "cure" (eight weeks were previously taken as the period of observation following treatment), the relapse rate in this Centre with quinine alone was 68 per cent (Sinton and Bird, 1929) [1], and with plasmoquine alone 22·7 per cent (Sinton, Smith and Pottinger, 1930) [2]. With plasmoquine 0·04 gramme and quinine 20 grains daily for twenty-one days, the relapse rate was 8·4 per cent (Sinton, Smith and Pottinger, 1930) [2]; so that the reduction of the dose of plasmoquine from 0·04 to 0·03 gramme daily in the twenty-one days' course has not reduced (but rather increased) the efficacy of the treatment.

Whether the absence of relapses in the thirty-one cases treated in 1931

is attributable merely to chance in a small series, or indicates a definite improvement on the eight per cent relapse rate in the series of seventy-five cases treated in 1930, it is difficult to say. The only differences in the routine of treatment known to us are: (1) we have used the bihydrochloride of quinine in simple solution in water, instead of the sulphate with citric acid and magnesium sulphate, as employed in 1930; (2) except for preliminary purgation with three grains of calomel, followed by salts, on the first day of treatment, we have discontinued the routine administration of calomel and salts during the treatment, and have prescribed a dose of salts only when a tendency to constipation appeared to indicate it. (In the previous year all cases were given, as a routine, three grains of calomel at the commencement, and a daily early-morning dose of salts throughout the course of treatment, and, in addition, one grain of calomel on two or three consecutive evenings for two periods, usually about the ninth and fifteenth days of treatment); and (3) we have confined all cases to bed for the first fourteen days of treatment in hospital.

With regard to these modifications, we would merely say that we believe the bihydrochloride of quinine in simple solution to be better tolerated and more effective than the sulphate mixture. Unfortunately, the cost is a little greater, but probably not so much as is generally imagined. The actual cost, at current prices, works out at about Re. 1·4 for one course of twenty-one days' treatment with the sulphate mixture, as compared with Re. 1·8 with the bihydrochloride. We believe that the exhibition of magnesium sulphate in each dose and frequent purgation with calomel are unnecessary; and we think that, frequently, an attack of malaria is treated too lightly, not only by the patient himself, but also by the medical officer who discharges the patient from hospital in a large proportion of cases in as short a time as five to seven days. We do not say that so long a period as twenty-one days in hospital is necessary under ordinary conditions, but we suggest that the minimum should be ten to fourteen days.

In August, 1931, the Director of Medical Services, India (in his letter, No. Z-9295 (D.M.S.3) dated August 4, 1931), recommended that Treatment "C," as defined above, be adopted as the standard routine treatment for benign tertian malaria in all military hospitals in India. It was then thought that there was little point in continuing to treat cases at this Centre by a "standard" method, and that it would be valuable to determine whether plasmoquine in still smaller doses (daily or total) would prove equally effective. It was therefore decided to institute two new courses, viz.:—

Treatment "F": Plasmoquine 0·01 gramme plus quinine 10 grains twice daily for twenty-one days (i.e., the same period as in Treatment "C," but a smaller dose of plasmoquine).

Treatment "J": Plasmoquine 0·02 gramme plus quinine 10 grains in the morning and plasmoquine 0·01 gramme plus quinine 10 grains in the

evening daily for fourteen days (i.e., the same dose of plasmoquine as in Treatment "C" but for a shorter period).

It should be noted that the total dose of plasmoquine for the whole course is the same in both "F" and "J," viz., 0·42 gramme.

Alternate cases were put on Treatments "F" and "J," and up to date twenty cases of benign tertian relapse have been treated, ten by each treatment. No relapses have occurred within an average period of twelve weeks after completion of treatment. Table III gives the actual number of weeks of observation in each case:—

TABLE III.

CASES TREATED BY TREATMENTS "F" AND "J" WITH NUMBER OF WEEKS OBSERVED.

	No. of cases			No. of weeks observed after completion of treatment
		Treatment "F"		
	1	..		8
	5	..		12
	2	..		13
	2	..		14
Total	10		Average	12·2
		Treatment "J"		
Total	10		Average	12

Although the numbers are small, the results are, at least, encouraging, and it would seem as if the smaller dose of plasmoquine would prove as effective as that given in Treatment "C." If this is so, then presumably "J," the fourteen days' course, would be preferable to either "C" or "F." The only advantage of "F" over the other two is that with a dose of 0·03 gramme plasmoquine daily slight toxic symptoms (slight cyanosis, etc.) are occasionally met with.

Table IV compares the results obtained in this Centre with various forms of treatment in chronic benign tertian malaria:—

TABLE IV.

Treatment	Daily dose × days: Plasmoquine gramme	Daily dose × days: Quinine grains	Total cases	Relapse rate	Reference
Quinine sulphate		30 (max.) × 21-56	667	68·0 per cent	1
Plasmoquine	0·08 × 28	—	22	22·7 ,,	2
Plasmoquine and quinine	0·04 × 21	20 × 21	44	8·4 ,,	2
"C" (1930)	0·03 × 21	20 × 21	75	8·0 ,,	
"C" (1931)	0·03 × 21	20 × 21	31	0·0 ,,	
"C" Total	0·03 × 21	20 × 21	106	5·7 ,,	
"F" ..	0·02 × 21	20 × 21	10	0·0 ,,	
"J" ..	0·03 × 14	20 × 14	10	0·0 ,,	

It may be well to make it clear that it is fully realized that some cases do relapse after return to their units. The actual numbers are impossible to gauge, as we have no follow-up system after the case leaves the Centres

The difficulties in the way of such a system are obvious, one of the chief being that of excluding the possibility of fresh infection. Nevertheless, the results given in Table IV are strictly comparable, and, as has been stated, in 1931 we gave practically each case four weeks' longer opportunity to relapse than in previous years before assuming "cure." It may be that plasmoquine and quinine do not completely sterilize the infection, but merely lengthen the period between relapses.

If further experience shows that Treatment "J" is as efficacious as Treatment "C," then the fourteen days' course of plasmoquine 0·03 gramme with quinine 20 grains daily might well be adopted as the standard treatment in place of the present twenty-one days' course, and it would be important to ascertain if the dose of plasmoquine might be reduced to 0·02 gramme daily. If sufficient cases present themselves, it is therefore proposed to compare the efficacy of the two following courses of treatment:—

Treatment "J": Plasmoquine 0·03 gramme plus quinine 20 grains daily for fourteen days.

Treatment "G": Plasmoquine 0·02 gramme plus quinine grains 20 daily for fourteen days.

If "G" proves as efficacious as "J," it is thought that it could be safely given as a general standard routine treatment, with no special supervision and no fear of even slight toxic symptoms.

V.—Toxæmia Due to Plasmoquine.

With doses of 0·03 gramme plasmoquine daily, toxic symptoms have been rare. In two cases only has slight cyanosis been noted. Abdominal pain has occasionally been complained of, but was never severe; there has been no complaint of it since the routine administration of calomel and salts was discontinued.

VI.—Treatment of Malignant Tertian Malaria with Plasmoquine and Quinine.

In 1931 only two relapse cases of malignant tertian malaria came under observation and were both given Treatment "F." Neither relapsed subsequent to treatment.

VII.—Treatment of Malaria with Atebrin.

In 1931 the D.M.S., India, arranged with Dr. Urchs, of the Havero Trading Company, Calcutta, for the supply of a new drug, called "atebrin" (originally issued as "erion"), to be tried out in the treatment of malaria. Atebrin is stated by the manufacturers (Bayer) to be "a derivative of the plasmoquine nucleus, to which a new side-chain is added, which gives the whole compound a dye-like character." They further state that "it is quickly absorbed by the small intestine and is slowly excreted unchanged by the kidneys and biliary tract" and that "the only so far observed bye-effect is a yellow discoloration of the skin, which has nothing whatsoever

to do with the insufficiency of the liver, as scleræ, etc., remain free from the discoloration, as well as the urine free from bile pigments."

They summarize the experiences gained so far as follows:—

"(1) In tertian and quartan malaria atebrin acts on both the schizonts and gametocytes.

(2) In subtertian malaria atebrin only acts on the schizonts; it is ineffective against the gametocytes. Similarly to quinine, it even appears to stimulate the formation of gametocytes. In subtertian malaria it is therefore necessary to combine atebrin with plasmoquine.

(3) According to present experiences daily doses of 0·3 g. atebrin appear to yield the best results. Further experiments must show whether the daily dose of 0·2 g. can be reduced in certain cases.

(4) In subtertian malaria atebrin must be combined with plasmoquine. Later experiences must show which combination is most satisfactory. Up to now, daily doses of 0·3 g. atebrin plus 0·03 g. plasmoquine have been administered with good results.

(5) For the pure atebrin treatment as well as for the combination atebrin-plasmoquine continuous treatment should be the object. According to present experiences, a treatment lasting from five to seven days may probably be sufficient. This point must, however, first be cleared up by further experiments, especially the question as to whether relapses are likely to occur after such a short period of treatment.

(6) Of by-effects only the yellow discoloration has so far been remarked, and this is certainly not to be attributed to icteric changes but to a discoloration of the skin caused by the medicament.

(7) Atebrin is retained by the body for a very long time. For this reason it is probably very suitable for prophylactic purposes."

Plasmoquine, although effective against the gametocytes as well as the schizonts of benign tertian and quartan malaria, is effective against only the gametocytes and not the schizonts of malignant tertian malaria. The manufacturers believe that in atebrin they have found a drug that is effective against M.T. schizonts and that, therefore, a combination of atebrin and plasmoquine may prove the ideal treatment for malignant tertian malaria.

Unfortunately, so far as opportunities for testing the drug are concerned, we have very few cases of malaria at the Centre in the cold weather, and have been able to try the drug in only 5 cases (2 benign tertian and 3 malignant tertian). But it is possible that observations on these may be of some value and interest, as indicating whether the drug is worthy of further trial.

All five cases were given the same course of treatment, viz., atebrin 0·1 gramme thrice daily, at 7 a.m., 2 p.m. and 9 p.m., for seven days (labelled, for convenience of reference, Treatment "K"). Except for preliminary purgation with calomel and salts, they had no tonic or other medicinal treatment apart from the atebrin. During the seven days' course

they were kept in bed on a cellulose-free diet, as the makers point out that "laboratory experiments have shown that taken especially with food containing cellulose atebrin is only partly absorbed, and that it is, therefore, possible that, if the gastro-intestinal tract is filled with food containing cellulose, the action of atebrin is reduced." After completion of the seven days' specific treatment, the cases were put on a liberal mixed diet and allowed up for two, four and six hours respectively on the three following days, then up all day and discharged from hospital on the fourteenth day after commencement of treatment, to attend the Centre for daily observation (including blood-smear and test for excretion of atebrin in the urine).

The following are the salient features of the five cases :—

Case 1. Benign tertian malaria.—Pte. E. arrived at the Centre on October 2, 1931. His medical history sheet showed that he had been in hospital with benign tertian malaria (fresh) from August 27 to September 6, 1930 (eleven days), and again with benign tertian (relapse) from September 16 to 29, 1931 (fourteen days).

At the routine weekly examination on December 18, 1931 (i.e., after eleven weeks at the Centre) his blood-smear showed the presence of benign tertian parasites (rings and trophozoites). He had no symptoms whatever. He was, however, admitted to hospital forthwith. On December 19 the red cell-count was 5·0 million, hæmoglobin 84 per cent, total white cell-count 7,500. Differential count : neutrophils 60 per cent, lymphocytes 29 per cent, monocytes 9 per cent, eosinophils 2 per cent. There was no palpable enlargement of the spleen, although there was tenderness on deep palpation under the costal margin. In the afternoon of the same day he had a typical pyrexial attack, with a maximum temperature of 102° F. That evening and the following day (December 20) his temperature was normal. On the fourth day (December 21) a course of atebrin was commenced, and it was decided to give him 0·1 gramme thrice daily (at 7 a.m., 2 p.m., and 9 p.m.) for seven days (Treatment "K").

After the second dose (on December 21) he had a second pyrexial attack, with a maximum temperature of 103° F. The temperature fell to normal the same day, since when he had no further fever.

During the course there was no discoloration of the skin and no toxic symptoms whatever, and apart from the actual pyrexial attacks the patient felt perfectly fit.

The parasites disappeared from the peripheral blood within forty-eight hours of starting the course.

The red count had risen from 5·0 to 5·4 million and the hæmoglobin from 84 to 89·5 per cent at the end of the sixth week after completion of treatment, and to 5·6 million and 90·9 per cent at the end of the ninth week, and to 5·8 million and 97·9 per cent at the end of the thirteenth week. This in all probability represented real and definite improvement in the blood condition, and was not due to the effect of altitude. (See Section VIII).

He has remained free from relapse for thirteen weeks after completion of treatment, blood-smears having been examined daily during that time.

His weight on arrival was 143 pounds, on admission to hospital eleven weeks later 152 pounds, and thirteen weeks after treatment 150 pounds.

Case 2. Benign tertian malaria.—Gunner M. arrived at the Centre on September 21, 1931, with a history of at least eight attacks of malaria, three (all benign tertian) being within the previous twelve months. He had completed twelve weeks' observation without relapse and had been given a fourteen days' course of plasmoquine 0·02 gramme plus quinine 20 grains daily, preparatory to returning to his unit, when he was admitted to hospital on account of laryngitis. He had been in hospital fifteen days and was recovering from the laryngitis, when, on January 13, 1932, he had a typical malaria attack, with a recorded maximum temperature of 101° F. Benign tertian trophozoites and schizonts were present in blood-smears. The following day the temperature was normal and Treatment "K" was commenced. On the third day, January 15, he had a second febrile attack with a maximum temperature of 103° F. The temperature fell the same day and from then onwards he had no further fever.

No discoloration of the skin and no toxic symptoms occurred.

The asexual forms of the parasite disappeared from the peripheral blood within eighty-four hours of commencement of treatment. Sexual forms were seen for the first time on the fourth day and had again disappeared by the sixth day of treatment (present for forty-eight hours).

The red blood-count was 4·8 million both at the beginning and at the end of the seven days' treatment, but nine weeks later had risen to 5·1 million. He started treatment with a hæmoglobin percentage of 81·3; at the end of seven days' treatment this had risen to 92·3, and nine weeks later it stood at 89·5.

The excretion of atebrin in the urine began on the second day and continued for *thirty-seven days*.

He has so far remained free from relapse for ten weeks.

His weight has remained more or less stationary, round about 150 pounds during his stay in Kasauli.

Apart from the question of the efficacy of atebrin this case is interesting. He relapsed sixteen weeks after arrival at Kasauli, thus illustrating the fact, which, of course, we realize, that we miss a certain number of relapses by keeping convalescents under observation for only twelve weeks. Further, he relapsed about two weeks after completing a fourteen days' course of plasmoquine 0·02 gramme plus quinine grains 20 daily. In that fortnight he suffered from an attack of acute laryngitis, which may have determined the onset of the malaria relapse; but, in any case, the course of plasmoquine and quinine had obviously failed to sterilize the malaria infection, if it did not actually induce the relapse.

Case 3. Malignant tertian malaria.—Driver C. arrived at the Centre

on December 25, 1931. His medical history sheet had eight entries of malaria, one benign tertian in 1929, and seven malignant tertian between November, 1929, and November, 1931.

On January 8, 1932, two weeks after arrival, the routine weekly blood-smear revealed malignant tertian rings and crescents. He had no fever or other symptoms. Rings and crescents were still present on the fourth day but had still produced no symptoms. He was, however, then put on Treatment "K." He developed no symptoms, toxic or other, and no discoloration. The rings disappeared from the peripheral blood within thirty-six hours of commencing treatment, but crescents were found on daily examination for *fifty days.*

The red blood-count and hæmoglobin percentage at the beginning and end of the seven days' treatment were 4·8 million and 81·3 per cent, and 4·6 million and 85·6 per cent respectively. Six weeks from the end of treatment they had risen to 5·2 million and 89·5 per cent and four weeks later to 5·4 million and 90·9 per cent.

The excretion of atebrin in the urine began on the fourth day of treatment and continued for sixteen days.

He has remained free from relapse for ten weeks since completion of treatment, and has put on about five pounds in weight.

Case 4. Malignant tertian malaria.—Gunner L. arrived at the Centre on February 6, 1932. According to his medical history sheet he had had one attack of malignant tertian malaria (fresh) and one attack of benign tertian (relapse) in November, 1931, and one attack of malignant tertian (relapse) in December, 1931. He was again in hospital from January 18 to 28, 1932, with benign tertian (relapse).

Malignant tertian rings were present in the blood-film on the day of his arrival. Rings continued to be present and gametocytes appeared on the fourth day, although no symptoms had developed. Treatment "K" was then begun. The rings disappeared within forty-eight hours and the crescents within seventy-two hours of commencement of treatment. He developed no fever, or discoloration, or other symptoms.

The red count was 4·6 million and the hæmoglobin 73·7 per cent at the beginning, and 4·8 million and 81·3 per cent respectively at the end of the seven days' treatment. Five weeks later the figures had risen to 5·2 million and 89·5 per cent. (This is a greater increase in hæmoglobin than would normally be expected from altitude alone.)

The excretion of atebrin in the urine began on the fourth day and continued for thirty days.

He has been observed so far for six weeks without relapse.

His weight has remained fairly constant (about 146 pounds) during his seven weeks at Kasauli.

(*To be continued.*)

THE ÆTIOLOGY AND TREATMENT OF HEAT EXHAUSTION AND HEAT HYPERPYREXIA, WITH SPECIAL REFERENCE TO EXPERIENCES IN IRAQ.[1]

By T. C. St. C. MORTON, M.D., M.R.C.P., D.P.H.,
Squadron Leader, R.A.F.

I. *Climatology.*—The month of August, 1930, was characterized by a severe heat wave. The average shade temperature in Baghdad for the whole month was 114·4° F. The peak was reached about August 5th and 6th, when for three days the shade temperature reached 120° F.

In the Basrah-Shaibah area high temperatures were also recorded, the average daily shade temperature for the month being 115·3° F., with a peak of 120° F. to 122° F. between August 5th and 8th, 1930.

Meteorological charts are appended for both the Baghdad and Shaibah districts, but figures for Basrah were not available; this is unfortunate in view of its notoriously high humidity, and the marked difference in the incidence of heat exhaustion and heat hyperpyrexia in the Baghdad and Basrah areas.

The summer of 1931 was one of the coolest on record for Iraq; the maximum recorded shade temperature for Hinaidi was only 115·9° F. on July 20th and in consequence only one severe case of heat hyperpyrexia occurred.

II. *Case incidence of effects of heat.*—Baghdad area. Twenty-seven cases (twenty-six airmen and one nursing sister) of heat exhaustion occurred at Hinaidi, and eighteen or 66·6% occurred on August 7th or 8th at a time when the shade temperature had persisted at 120° F. for three days. 62·9% of these cases occurred amongst personnel employed on sedentary occupations in offices, etc. In 48% of these cases there was no history of exposure to the sun, eight were teetotalers, and seventeen had not completed one hot season in Iraq. The main symptoms were vomiting (18 cases), dizziness (13), constipation (11), cramps (6), suppression of urine (4), anidrosis (3). Three cases of heat hyperpyrexia occurred, and in no case had there been any exposure to the sun.

Basrah area. Three cases of heat exhaustion and four cases of heat hyperpyrexia occurred.

III. *Ætiology.*—At Hinaidi our experience has shown that the critical temperature is somewhere in the region of 119-120° F., and that the factor of humidity does not appear to enter into the question to any marked extent, as the humidity percentage here remained low throughout. The large percentage of cases in which there is no history of exposure is suggestive, and points to the fact that a high temperature *per se* will bring about heat exhaustion and hyperpyrexia in susceptible subjects in the absence of direct exposure to the rays of the sun. The pathogenesis of these cases appears to be of the nature of an auto-intoxication due to the failure

[1] A paper read before the United Services Section of the Royal Society of Medicine. March 14, 1932, and reprinted by kind permission.

of the excretory organs to get rid of the products of metabolism. In heat exhaustion this is evidenced clinically by a prodromal period of malaise, weakness, constipation and diminution of urine. This stage persists for from one to three days, and is followed in severe cases by collapse. The patient shows all the signs and symptoms of profound shock; this may possibly be due to the presence of some substance allied to histamine, which has been produced in the body as a result of faulty metabolism. The analogy to superficial burns is striking and suggests a similar pathology. In this connection Cramer's work on the production of heat hyper-

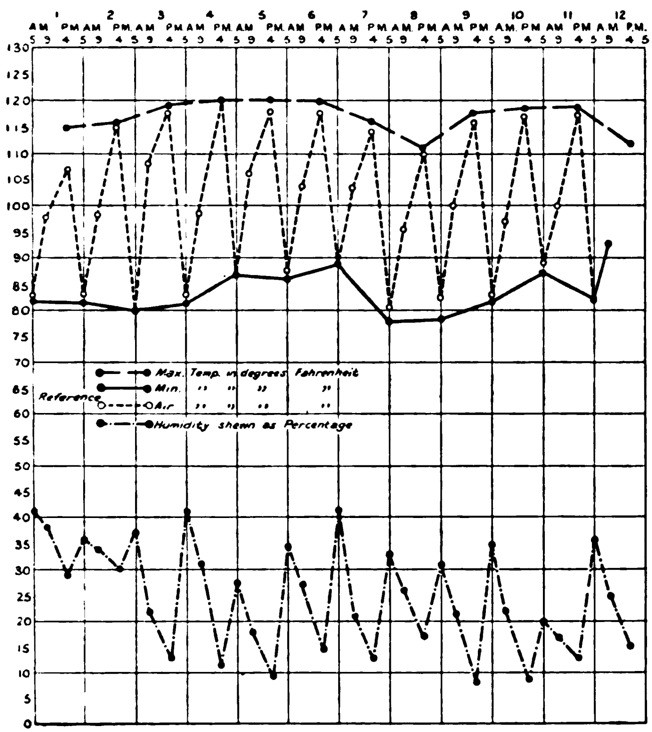

FIG. 1.—Maximum and minimum daily temperature and corresponding humidity at Hinaidi from August 1st to 12th, 1930.

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pyrexia in animals by the injection of β-tetrahydronaphthylamine is significant. The symptoms of shock gradually merge into a condition of acidosis.

The work of Hall and Wakefield on dogs and the experience of Marsh in cases of heat stroke in the Persian Gulf have shown that the following uniform changes occur in heat hyperpyrexia.

(*a*) There is a uniform increase in blood lactic acid. (*b*) The plasma carbon dioxide is reduced in consequence. (*c*) Twenty-four hours after the initial attack of hyperpyrexia, the blood urea increases probably on account of damage to renal parenchyma. (*d*) Diminution in man of blood chloride and urinary chlorides. This diminution is absent in non-sweating animals.

Willcox reports that in a few cases acetone and diacetic acid were present in the urine of cases of heat hyperpyrexia.

The abdominal and muscular cramps, which are such a distressing feature in many cases of heat exhaustion, yielded with dramatic suddenness to intravenous injections of sodium bicarbonate. These cramps are probably due to the accumulation of lactic acid in the system, and are possibly directly comparable to the muscular cramps that assail athletes after severe exercise,

Recent experiments on rabbits carried out by Dr. F. Marsh, of the Anglo-Persian Oil Company, have shown that as long as the body is kept cool, the shaved head of a rabbit can be exposed to the direct rays of the tropical sun with impunity,

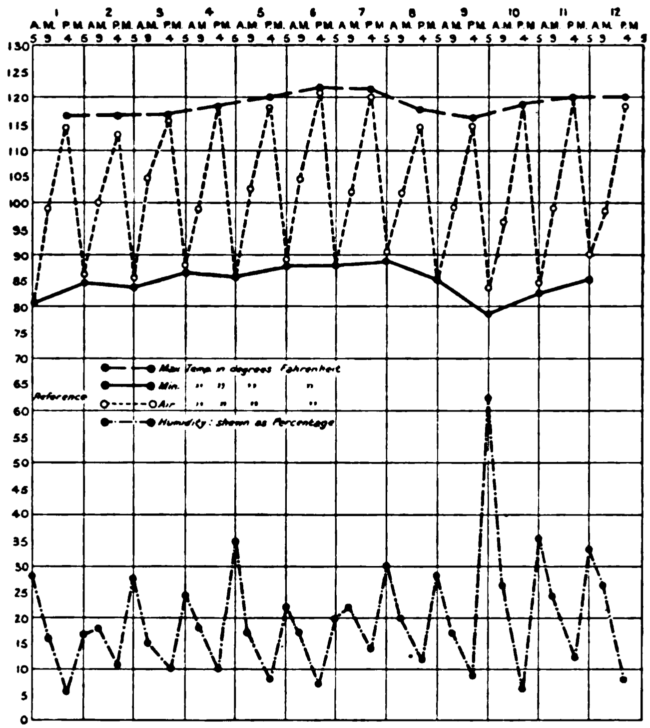

FIG. 2.—Maximum and minimum daily temperature and corresponding humidity at Shaibah, from August 1st to 12th, 1930.

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although control animals invariably died from hyperpyrexia when this precaution was not taken. It is very suggestive that in the Hinaidi series of cases, as already stated, there was no history of exposure to direct sun-rays, and in both the Baghdad and Basrah areas all the heat hyperpyrexia cases occurred amongst men working indoors. This appears to point to the fact that it is the combined infra-red and yellow rays that do the damage, and not the ultra-violet rays.

Heat hyperpyrexia and heat exhaustion are due to general "parboiling" and not to any mysterious property in the rays of the sun. I have spent many hours bathing, bareheaded, in the height of the summer in Iraq with no ill effects, nor have I ever heard of any cases of hyperpyrexia arising in this manner. The solar topee is of value purely as a cooling agent, and the reason why bareheaded individuals are liable

to suffer ill effects from exposure to the sun is simply due to the local parboiling of the blood in the brain raising the general temperature of the blood circulating in the body; this is as true of healthy individuals as of those already hyperthermic; as Sir Charles Martin has pointed out, there may be a direct heating effect on the brain itself. "Such a local addition of radiant energy to an already heated brain may be the explanation of cases of people who certainly were not sufficiently hyperthermic to be suffering from heat stroke, but yet became very ill with meningeal symptoms. Such cases are described in the literature. My interpretation of these cases is that

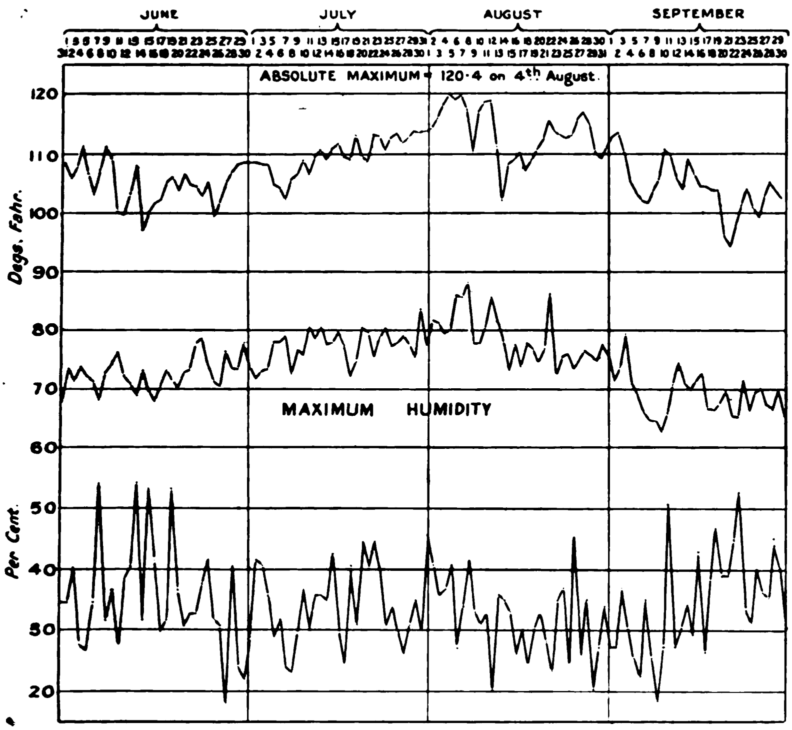

Fig. 3.—Maximum and minimum daily temperature and corresponding humidity at Hinaidi, from May 31st to September 30th, 1930.

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they are due to a local parboiling, not to general hyperthermalism." This quotation provides, I think, the clue to the diversity of symptoms and syndromes in the literature which tend to obscure the clinical picture. There must have been during the war a high incidence of so-called "heat strokes" resulting from the effects of high atmospheric temperature and exposure to the sun, occurring amongst undiagnosed cases of malaria, sandfly fever, enterica and other toxæmias.

IV. *Nomenclature.*—There appears to be no hard-and-fast line between severe heat exhaustion and heat stroke. In fact it would be advisable to abolish the latter term and substitute the term heat hyperpyrexia in its place. Heat exhaustion cases of the severe acidosis type will, if untreated, pass on to heat hyperpyrexia, and once the rectal temperature reaches 108°F., in exhaustion cases, coma, convulsions, etc., ensue, and the clinical picture is altered to that of hyperpyrexia, although the

essential pathology appears to be the same. In some of these cases the patients developed heat hyperpyrexia without suffering from any of the symptoms of heat exhaustion; this was probably due to an inherent instability of the heat centres in the individual concerned producing an early and initial anidrosis, but the disproportion between the incidence of heat exhaustion and hyperpyrexial cases in the Baghdad and Basrah areas points to a meteorological factor also being concerned. In my opinion the disproportion is due to the notoriously high humidity present at Basrah which tends to inhibit sweating. Unfortunately, no meteorological data for

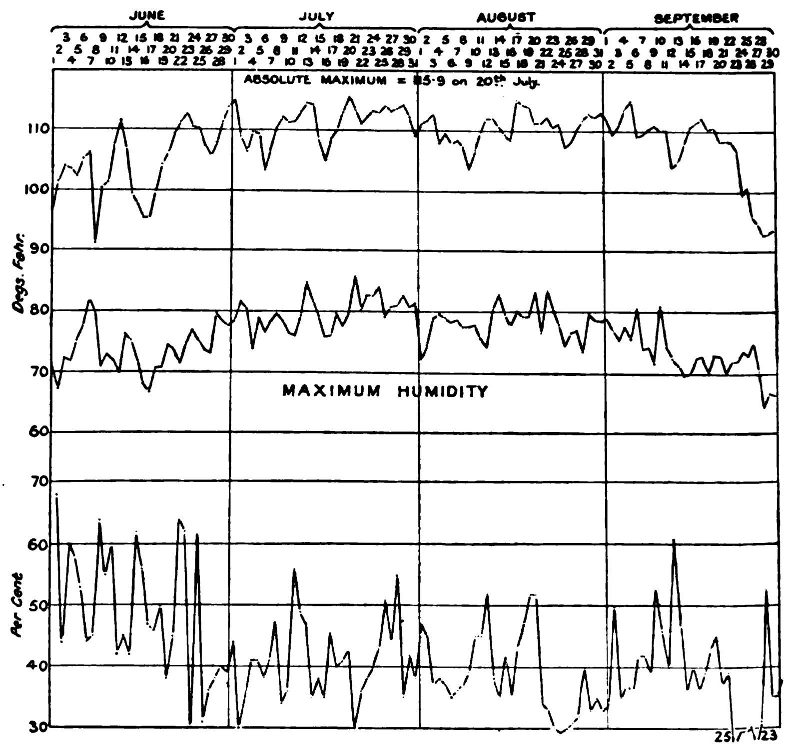

Fig. 4.—Maximum and minimum daily temperature and corresponding humidity at Hinaidi, from June 1st to September 30th, 1931.

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Basrah were available. What is often described as heat exhaustion is merely syncope.

V. *Epidemiology.*—It is well known that heat hyperpyrexia is especially prevalent in certain endemic zones. This is probably due to the fact that it is only in these zones that a constant high temperature is maintained over a period of time long enough to produce the metabolic changes that initiate the condition. The immunity in temperate zones from heat hyperpyrexia amongst furnace workers, stokers, etc., who in many instances are subjected to much higher temperatures than are found under natural conditions in the tropics, is due to the fact that they only work in short shifts. The break and return to a cooler atmosphere give their excretory organs

ample opportunity of getting rid of the accumulated products of metabolism. That this is so is clearly shown by the experience gained by the medical officers of the Anglo-Persian Oil Company in southern Persia, where an artificially cooled ward kept at a temperature of 60° F. is used for the treatment of heat-exhaustion and heat-stroke cases; they report that cases admitted to this ward suffering from severe heat exhaustion—i.e., frequent vomiting, abdominal uneasiness, muscular cramps, diminution of urine, etc.—have often, within an hour, been relieved of all symptoms.

VI. *Heat exhaustion.*—(*a*) Clinical features. In most cases the actual onset was sudden, but there had been a premonitory stage during which the patient complained of anorexia, weakness of the legs, headache and constipation, which lasted for three or four days, and was followed by sudden collapse in the severe cases. In many instances this collapse occurred at night and bore no relation to exertion. The patient in this stage showed all the symptoms of shock. As the immediate shock passed off, persistent and severe vomiting ensued, the vomitus eventually becoming bile-stained. The patient was pale, bathed in cold, clammy perspiration, mentally apprehensive, and in many cases in acute discomfort, due to violent cramps in the abdominal and leg muscles. Perspiration was, as a rule, profuse in this stage, but later on a certain proportion of the patients suffered from anidrosis. The urine was invariably diminished in quantity; in the severe cases there was retention and partial suppression, only 1½ to 2 oz. being drawn off in the twenty-four hours by catheter. An increase in the quantity of urine passed was always an early favourable sign of recovery. The axillary and mouth temperatures were often normal or subnormal, but the rectal temperature was invariably raised—usually to about 101° F. As the patient responded to treatment and the vomiting and cramps ceased so, *pari passu*, the mouth temperature rose, and a slight pyrexia appeared, which lasted for two or three days. In some cases headache persisted a week or ten days after convalescence was established.

(*b*) Mental changes. In one case, although there was no hyperpyrexia and the temperature was only 98·4° F. by mouth and 100·4° F. by rectum, there was maniacal delirium, and it was found necessary to anæsthetize the patient in order to administer an intravenous injection. Twelve hours later that patient was perfectly normal in every way.

(*c*) Pathology. Fortunately, no deaths occurred amongst the heat exhaustion series. Blood smears were taken in every case, and blood cultures and counts carried out in selected cases. One case of malignant tertian malaria was detected, and in another case, that of a nursing sister, although blood cultures were negative, persistent temperature led to further investigations being carried out, and *Bacillus typhosus* was isolated from the stools on the tenth day, and from the blood during a relapse. Unfortunately, owing to the pressure of work, no estimations of blood urea or lactic acid, etc., were carried out during the epidemic; blood urea estimations have since been carried out on the severe cases before discharge from hospital, and no case of permanent renal damage has been detected, though in one case the blood urea was slightly raised one month after recovery.

(*d*) Treatment. (i) Preliminary purgation and treatment for shock; (ii) the following mixture was given hourly for the first twenty-four hours: glucose 1 drachm; sodium bicarbonate 15 gr.; water up to 1 oz. In certain cases where this was not well tolerated, potassium citrate 25 gr. was given instead. If neither

TABLE I.—HEAT HYPERPYREXIA—ÆTIOLOGICAL FACTORS.

Case No.	Age	Time in Iraq in months	Nature and Conditions of Work	Habits—Alcohol	Exposure and Onset
1	23 years	22	In detention	Unknown	Had been 45 days under treatment for venereal disease in 1930, and 162 days similarly in 1929
2	38 years	22	Fire station	Heavy drinker. Plays no games	Admitted hospital 3.8.30 with typical sand-fly fever. Very fat, alcoholic. On 6.8.30 complained of pain in back. N.A.D. chest. Put on whiskey 1 oz. 4-hourly as delirium tremens was diagnosed. Marked tremor of tongue, jaw muscles and hands present. On 7.8.30 mental condition worse, whiskey increased to 8 oz. in 24 hours. Pot. bromide given. Temp. in ward was 100° F. in spite of fans and ice. On evening of 7.8.30 became delirious and temperature began to rise. At 20·00 hours temp. suddenly rose to 109·6° F.
3	33 years	10	Aircraft hand. Indoor work	States one bottle of beer a day. Swims and plays football	Admitted to hospital on 6.8.30 with rectal temp. of 104° F. Complaining of general pains and headache. Not perspiring
4	25 years	10	Clerk. Two fans in office, brick building with verandah	Beer, two bottles a day. No games	No history of exposure. Had not been feeling well for a few days, suffering from diarrhœa. On 2.8.30 was admitted to S.S.Q. with headache. Temp. 103° F. Eyes congested. On 8.8.30 at 14·00 hours became delirious. Temp. 107° F. Pulse 140. Rectal temp. up to 112° F.
5	23 years	10	Fitter A.E. Works in room with corrugated iron roof	Teetotal. Fences. Swims	No history of exposure. On 7.8·30 had been to Basrah on a trade test board. He reported sick on return, complaining of weakness, headache, dizziness. Temp. 100·4° F. Pulse 88. Not constipated. On 9.8.30 rectal temp. rose to 107° F.
6	48 years	13	W. and B.	Beer, three bottles a day. Had no alcohol for ten days previously	No history of exposure. Patient was admitted to hospital with furunculosis on 30.7.30. Developed heat hyperpyrexia. Temp. 109·6° F.
7	23 years	22	Fitter. Armourer. Works in armoury workshop. Two fans in use. Brick building	Beer, two to three bottles a day. Cricket. Swims	No history of exposure. Had spent morning at a trade test board at Basrah on 8.8.30. Felt ill and returned at mid-day in an open touring car. Helmet and spine pad worn. Found in bungalow in a delirious condition. Transferred to sick quarters. Constipated.

TABLE II.—CLINICAL FACTORS.

Case No.	1	2	3	4	5	6	7
Date of admission	6.8.30	3.8.30	6.8.30	2.8.30	7.8.30	7.8.30	9.8.30
Prodromal malaise	+	+	+	+	+	+	+
Anidrosis	+	+	+	+	+	+	+
Constipation	—	—	+	—	—	—	+
Temp. on admission: mouth	—	103°	103°	103°	100·4°	—	—
Temp. on admission: rectal	—	—	104°	—	—	—	108°
Highest temperature recorded	—	109·6°	108·4°	112°	107°	109°	108°
Delirium	—	+	+	+	—	+	—
Coma	+	+	+	+	—	+	+
Convulsions	—	+	—	+	—	+	—
Pupils	—	Dilated	Dilated	Dilated	—	—	—
Tongue furred	—	+	+	—	—	—	—
Vomiting	+	+	+	+	—	—	—
Suppression of urine	—	—	—	—	—	—	—
Incontinence	—	+	+	—	—	—	—
Duration of fever	—	4 days. (Sand-fly fever concurrently)	—	—	3 days	8 days	3 days
Results and remarks	Died suddenly in S. S. Q after removal from prison	Died. Case arose whilst patient was in hospital. Complicated by alcoholism	Recovered after prolonged treatment and many relapses. Very satisfactory case	Recovered. Very satisfactory case	Recovered	Recovered. Case arose whilst patient was in hospital	Recovered.

of these was retained, from 1 to $1\frac{1}{2}$ pints of 2% of sodium bicarbonate in saline was given intravenously. This was combined with 5% glucose in certain cases, apparently with benefit. The effect of the intravenous injection was dramatic, the vomiting ceased, the cramps in the muscles actually ceased in one instance whilst the transfusion was being carried out, and in every case within forty-eight hours the patient was practically convalescent. One transfusion sufficed in every instance.

VII. *Heat hyperpyrexia.*—(*a*) Clinical features. There were seven cases of heat hyperpyrexia, three at Hinaidi and four in the Basrah area. (See Tables I and II.)

The striking point is that in no case was there any history of exposure to the direct rays of the sun. It is of interest that in the case which occurred in the R.A.F. General Hospital, Hinaidi, the temperature of the ward at the time reached 100° F., whilst the patient—a plethoric and alcoholic individual—was admitted suffering from sand-fly fever with a temperature of 103° F., and appeared to be on the verge of delirium tremens as evidenced by marked tremor, slurring of speech, restlessness and insomnia; he was therefore the worst possible subject.

(*b*) Therapeutic measures.—Great difficulty was experienced at the R.A.F. General Hospital, Hinaidi, in keeping the wards sufficiently cool. In spite of lavish supplies of ice and the free use of fans, it was difficult to keep the temperature below a minimum of 100° F. during the peak of the heat wave. This undoubtedly increased nursing difficulties and threw an extra strain on the patients. For example, in one case, for ten days the rectal temperature rose to 108° F. from one to three times in the twenty-four hours, entailing repeated ice sponging, ice enemata, etc. Ultimately a cool air chamber was devised by hanging sheets over his bed on cradles, and suspending ice in water-proof bags from the centre. The tunnel thus made was left open at both ends, and a large table fan at the patient's head blew cooled air through, keeping it at an even temperature of 89° F. By these means his temperature was kept between 99° F. and 102° F., and he ultimately recovered.

An artificially cooled ward kept at 60° F., such as that referred to (p. 205), would have been invaluable in the treatment of these cases. The treatment of this condition is to reduce the temperature as soon and as effectually as possible by the application of cold; iced enemata are not recommended as they interfere with the taking of the rectal temperature, and the rectal temperature affords the only certain index as to the moment to initiate therm-antidote measures. Intravenous injections of alkalies and glucose were disappointing in their results in these cases; in marked contradistinction to their striking success in heat exhaustion, their value in heat hyperpyrexia is prophylactic, not curative. The essential factor is the provision of a specially cooled ward. Profiting from our experience in 1930, attempts were made in 1931 to improvise artificial methods of cooling, and a considerable measure of success was finally achieved. The radiator of a Leyland lorry was kept filled with ice, and a fan drove air through this radiator by means of a tunnel into a small one-bedded bunk. By this means a constant temperature of 82° F. was obtained in this room at a time when the general ward temperature rose to 95° F. An opportunity arose in July, 1931, of testing the value of this ward. A severe case of heat hyperpyrexia was admitted.

Patient was a non-commissioned officer, aged 38, who had served in Iraq for twenty-seven months. He worked as a storekeeper in an indoor job. His working hours were from

7 to 12 a.m., and he had taken no exercise for the last year. He drank about eight pints of heavy English beer a day. On July 29, 1931, he noticed some abdominal uneasiness, and had been feeling off colour for from two to three days. On July 30 he vomited three or four times, and noticed some frequency of micturition. He reported sick, and was admitted to hospital in a collapsed state the same day.

Condition on admission.—A fat, plethoric, alcoholic man. Face congested, pupils contracted, breathing stertorous, skin dry and hot, knee- and ankle-jerks absent. Heart, lungs and abdomen normal. Blood-pressure, 180/90. Mouth temperature, 104·8° F. Rectal temperature, 107° F.

The patient was ice-sponged, and his temperature fell to 104° F. by mouth and 105° F. per rectum. He was given a magnesium sulphate enema with excellent results, and was placed on sodium bicarbonate 10 gr., and glucose by the mouth hourly. Unfortunately, owing to a mistake, a specimen of urine was not saved for examination. Blood-films were taken, and were negative for malaria. Blood-culture taken.

31.7.31. Improved considerably. Mouth temperature, 103° F. Rectal temperature, 104° F. Urine alkaline. Sodium bicarbonate and glucose mixture four times in the twenty-four hours. Blood-film negative for malaria.

1.8.31. Much better. Temperature: mouth, 101° F.; rectal, 102·5° F. Blood-pressure, 145/90. Marked incoordination of hands. Knee- and ankle-jerks still absent. No sensory changes. Urinary chlorides, 0·29%. Nothing else abnormal.

2.8.31. Temperature: Mouth, 100·8° F.; rectal, 101·5° F.

Blood-count.—Total white cells, 7,800. *Differential count.*—Small monos., 10%; large monos., 6½%; transitionals, 13½%; polys., 68½%; eosinos., 1½%. Blood-urea, 35 mgm. per 100 c.c. Foot-drop and wrist-drop developed. Case diagnosed as alcoholic peripheral neuritis. Splints put on.

3.8.31. Much improved. Temperature, 99° F. Urinary chlorides 0·06%. Blood-culture sterile.

6.8.31. Urinary chlorides, 0·8%. Temperature has remained normal for the last twenty-four hours.

The patient was sent home on 22.8.31, the extensors of his hands and right foot being still paralysed.

Prevention of heat hyperpyrexia in fever cases in hospital.—(1) Provision of an artificially cooled ward. (2) Potassium citrate lemonade made by adding from 10 to 15 grains of potassium citrate to a glass of home-made lemonade. A pint of this was given three times a day to all pyrexial cases.

This scheme was adopted early in the summer as it was found that the urine in many sand-fly fever cases was intensely acid, full of albumin and contained casts and red blood-corpuscles.

The lemonade was given as a routine in every case of pyrexia during the very hot weather and proved of considerable value. In my opinion it is worth advocating as a prophylactic measure for healthy people during a heat wave.

Estimation of urinary chlorides.—Dr. F. Marsh observed a diminution of urinary chlorides in a case of heat hyperpyrexia (*Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1930, p. 257). This diminution occurred in the case reported above, but unfortunately no further opportunity arose in 1931 to confirm it. In order to obtain standard figures for healthy people in the tropics as to the amount of chlorides normally present in the urine, daily observations were carried out on three laboratory assistants during the month of August, 1931,

when the average shade temperature was 110° F. The assistants were employed in sedentary indoor work. An elaborate table was exhibited showing the daily observations, of which the following is a synopsis. The average of fluids ingested during the twenty-four hours was 3,672 c.c. (approximately 129 oz.), and in the same period 737·9 c.c. (approximately 26 oz.) of urine was passed with a chloride percentage of 1·07, or 7·8 grm. in the twenty-four hours. In temperate climates 1,450 c.c. (approximately 50 oz.) of urine is passed in the twenty-four hours with a chloride percentage of 1, or 15 grm. In hot weather, therefore, according to this test, only about half the quantity of chlorides is passed in the urine, although the percentage remains practically the same.

(*c*) *Pathology*. (i) Post-mortem (two cases).—The meninges and brain substance were markedly congested and hyperæmic. The heart was found contracted and stony hard, and the blood was very fluid. Smears taken from the brain, spleen and blood were all negative for malaria. Apart from the above, nothing abnormal was found except in the case of the N.C.O., whose heart showed an advanced fatty change.

(ii) Blood changes.—In one very severe case of heat hyperpyrexia repeated examinations were carried out during the course of the fever; an interesting feature was the leucocytosis and marked polymorphonuclear increase. No underlying disease could be found to account for these blood changes, and on looking up the records a similar finding occurred in a fatal case of heat hyperpyrexia during the 1926 group of cases. The following are the differential blood counts:—

Total white cells per c.mm.—24,000 (9.8.30), 18,000 (11.8.30), and 8,200 (12.8.30).

Differential count:—

	9.8.30.	12.2.31.
Small mononuclears ...	8 %	15%
Large " ...	4 %	10%
Transitionals	3·5%	4%
Polymorphs	83 %	70%
Eosinophils	1·5%	1%

A blood-urea examination in this case carried out one month after the illness showed a slight increase (45 mg. of urea per 100 c.c.).

Prophylaxis during hot weather. (1) Dietary.—There is no doubt that the diet of the British other ranks during the hot weather in the tropics is physiologically unsound. I am convinced that the relative immunity to the effects of heat amongst Indian troops is due, to a considerable extent, to dietetic factors. The B.O.R. will insist on getting his rations, a ration eminently suitable for hard manual work in a temperate climate, a diet too rich in proteins and fat and much too poor in carbohydrates for the tropics. Custom has ordained that the main meal is eaten in the heat of the day instead of in the cool of the evening; some day this will be altered, but—not in our time.

The universal popularity of salted almonds, chip potatoes, etc., in the tropics is due to a natural craving to make good the salt deficiency resulting from excessive sweating, the obvious conclusion is greatly to increase the salt content in the diet. Alkalies are normally present in vegetables; where these are not procurable, the ingestion of small quantities of sodium and potassium citrate added to lemon drinks is advisable.

(2) Fluids.—It is unfortunate that the normal brands of beer supplied in the

tropics are so heavy. Canteens should be forbidden to supply alcoholic refreshment until six p.m.; fresh lemon and orange drinks should be supplied at reduced charges to the troops. Well-diluted whiskey-and-soda appears to me to be the best alcoholic drink in the tropics, and I have often considered it unfortunate that the B.O.R. is restricted to beer, a notoriously unsuitable beverage in hot weather. Men should be warned that relatively enormous quantities of fluid are necessary after exercise in the tropics. I have a conviction that perhaps due to the windy insufficiencies that masquerade as teetotal drinks, most teetotalers and women do not drink enough fluid to make good tissue loss, and that perhaps is the reason why so many of them crack up in hot weather; on the other hand, there is no doubt whatsoever that the chronic alcoholic is very prone to go down with heat hyperpyrexia, but this is due to two factors, namely, the ingestion of alcohol during the heat of the day and defective excretion of products of metabolism due to diseased liver and kidneys.

(3) Exercise.—Daily regular exercise is essential and helps to tone up the whole excretory system. Newcomers are rather apt to over-exercise at first; it is a wise rule to lay down a certain standard suitable to one's individual needs, for example, three sets of singles at tennis, and adhere rigidly to this, no matter how much one may be tempted by the competitive spirit to continue the game.

(4) Shade temperature and work.—Apparently a shade temperature of 120° F. persisting for more than three days is the essential factor in the production of an epidemic of heat exhaustion and hyperpyrexia as far as Iraq is concerned. Such heat waves are exceptional and usually only occur at rare intervals; I therefore strongly recommend that all routine work be suspended as far as possible during such a period, and that emergency measures in the provision of extra ice, etc., be adopted to deal with the situation. By meteorological observation similar critical temperatures can doubtless be obtained for all tropical stations and the necessary precautionary measures be adopted. Until, however, artificially cooled wards are provided for serious medical and surgical cases in every tropical hospital, the spectre of heat hyperpyrexia will hang like a nimbus over the head of the operating surgeon, physician and patient.

In conclusion, I would like to express my thanks to Group Captain A. V. J. Richardson, O.B.E., Principal Medical Officer, Royal Air Force, Iraq, in 1930, for his valuable criticism, advice and assistance in the preparation of this paper, and to my colleagues of the Royal Air Force Medical Service for their cordial co-operation, loyal assistance and helpful suggestions in the treatment of these cases.

Clinical and other Notes.

REPORT ON A CASE OF PNEUMOCOCCAL MENINGITIS AS A PRIMARY INFECTION, WITH COMPLETE RECOVERY.

By Major E. P. N. Creagh,
Royal Army Medical Corps.

Pneumococcal meningitis is a comparatively rare infection and is looked on as invariably fatal. For these reasons the case is considered worthy of record.

The patient, aged 18, was a well-developed young signalman of six months' service. His previous medical history was excellent. He was quite well until the evening of the day before his admission to hospital. He then developed a severe headache, vomited and spent a very restless night. On admission he presented a textbook picture of severe acute meningeal irritation. He was mildly delirious, complaining of severe headache, very irritable and resisting examination. At short intervals, violent projectile vomiting took place. He lay curled up in bed with his eyes closed. His temperature was 103·6° F. and pulse-rate 110 per minute. At this stage nuchal extension was not marked. Lumbar puncture under a general anæsthetic yielded forty cubic centimetres of turbid fluid under moderate pressure. This was replaced by twenty-five cubic centimetres anti-meningococcal serum.

The report on the turbid fluid was as follows : protein much in excess, glucose absent.

The centrifugalized deposit consisted of pus, 98 per cent of which was degenerated polymorphs. It contained only a few Gram-positive lanceolate diplococci in pairs and short chains mainly extra-cellular, but a few were intra-cellular. In most of the subsequent specimens no organisms were seen, occasionally degenerated forms were present.

At the onset of the relapse, on the twenty-third day of the illness, morphologically perfect pneumococci were again seen, and the first of many attempts to culture them was successful.

The report on the culture was as follows :—

A Gram-positive diplococcus was grown in pure culture on Filde's medium. The colonies were small, circular, very transparent and slightly depressed, the appearance being identical in every respect with the pneumococcus. The organism was non-hæmolytic and bile-soluble. Further tests unfortunately could not be carried out as the growth was contaminated by the *B. subtilis*.

A detailed description of the case would take up too much space. It is proposed, therefore, to give a summary of the salient clinical features together with the treatment.

The patient was gravely ill for eighteen days, during which time there were slight remissions and exacerbations. From the nineteenth to the twenty-second day there was a definite period of remission of symptoms and pyrexia. Then followed a severe relapse, during which the patient was again very critically ill. There was gradual improvement from the thirtieth day. On the thirty-sixth day the temperature reached normal and convalescence was established.

Symptoms did not differ markedly from those of a severe case of meningococcal infection. Headache, photophobia and nocturnal delirium were most distressing. Violent projectile vomiting persisted for many days and was again in evidence during the relapse. Constipation persisted throughout. The patient did not have a natural evacuation of the bowels until he had been convalescent for over a week. There was occasional incontinence of urine. The patient lay for the most part in the prone position with his face buried in the pillows. There was very marked hyperæsthesia of the trunk and lower limbs. There was rapid loss of flesh; from being muscular and well covered the patient became emaciated in three weeks. The pyrexia was irregularly remittent from 103·8° F. to 100° F., occasionally almost touching normal; *vide* chart. The pulse was always of regular rhythm and its rate seldom exceeded 100 per minute.

Lumbar drainage was performed on fifteen occasions. The consistency of the fluid varied from day to day; at its worst there was a sediment of about 1½ inches of pus in the test tube after standing for half an hour. The last lumbar puncture was performed at the end of the first week of convalescence. The fluid was then for the first time absolutely clear, and had a cell count of forty per cubic millimetre; these were degenerated polymorphs and epithelial cells. The greatest amount of fluid removed on any one occasion was seventy cubic centimetres, this was during the relapse. There was well-marked xanthochromia on one occasion, presumably due to a hæmorrhage resulting from the previous puncture.

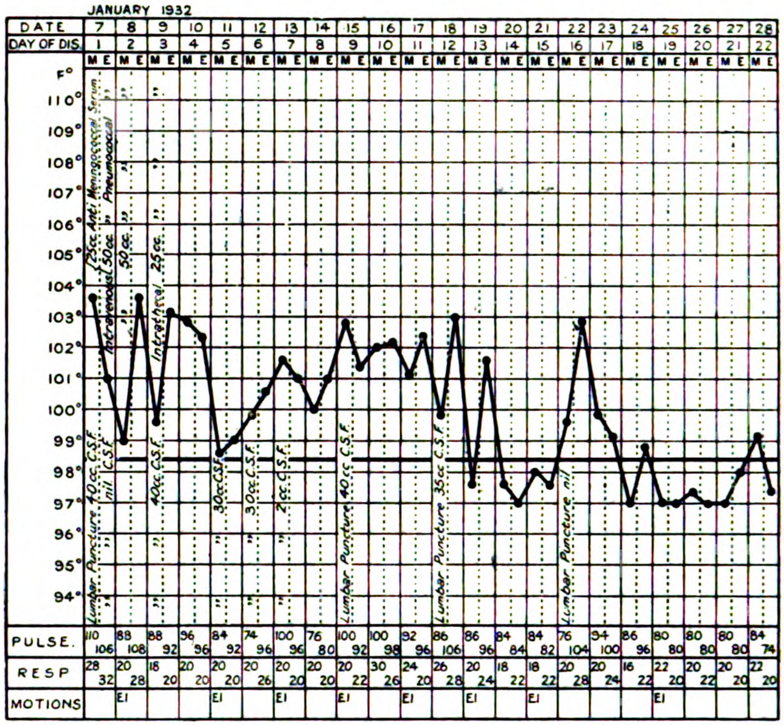
The deep reflexes varied with the intensity of the symptoms, but were for the most part absent during the height of the disease. The plantar reflex was never extensor. The superficial abdominal reflexes were absent while the patient was severely ill.

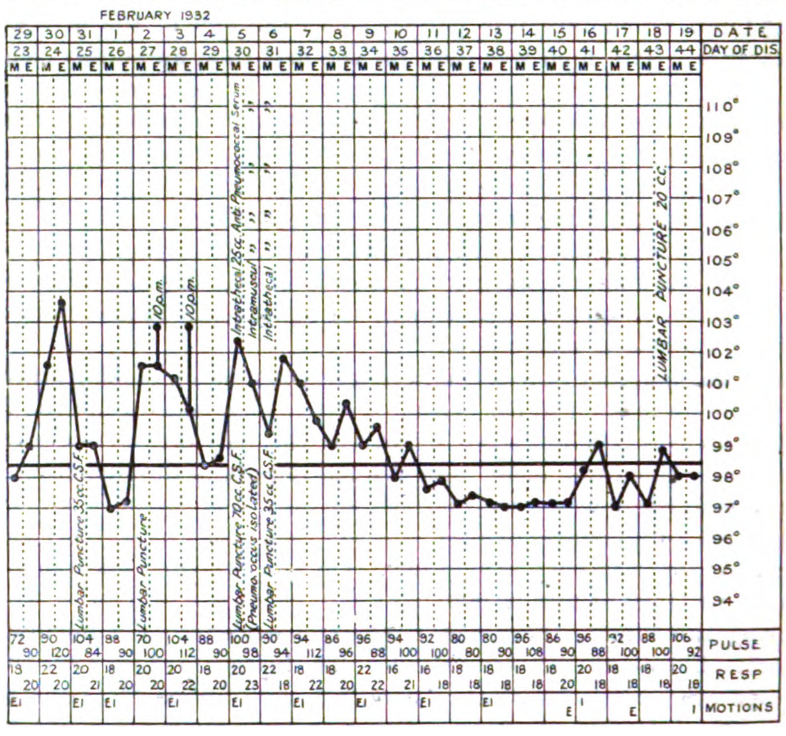
There was paresis of the left external rectus muscle, causing strabismus and diplopia on looking to the centre or left. This lasted from the fifth to the seventh day. The left sixth nerve was the only cranial nerve to show dysfunction. The fundi oculi were absolutely normal throughout.

Head retraction was very marked, so also was Kernig's sign. This latter persisted into convalescence.

Leucocytosis was surprisingly low. On the first and sixth day of the illness the total count was 10,000.

During the illness, there was never any evidence of a pneumococcal septicæmia, blood-cultures being sterile. The lungs remained clear throughout, despite the administration of open ether on fifteen occasions and the nature of the infecting organism. Other systems remained unaffected.


JANUARY 1932
DATE
DAY OF DIS.
F°
PULSE.
RESP
MOTIONS
Lumbar Puncture 40 cc. C.S.F.
Intravenous 50 cc.
25 cc. Anti Meningococcal Serum
Pneumococcal
Intrathecal 25 cc.
Lumbar Puncture 35 cc. C.S.F.
Lumbar Puncture nil


FEBRUARY 1932
DATE
DAY OF DIS.
PULSE
RESP
MOTIONS
Lumbar Puncture 35 cc. C.S.F.
Lumbar Puncture
10 p.m.
Intrathecal 25 cc. Anti Pneumococcal Serum
Intramuscular
Intrathecal
Lumbar Puncture 70 cc. C.S.F. (Pneumococcus isolated)
Lumbar Puncture 35 cc. C.S.F.
LUMBAR PUNCTURE 20 CC.

Specific Treatment.—Lumbar drainage, as already mentioned, was carried out fifteen times under general anæsthesia. As soon as the diagnosis was made after the first lumbar puncture, anti-pneumococcal serum was administered intrathecally and intravenously for three days, and afterwards during the relapse. Twenty-five cubic centimetres was the intrathecal dose, but larger quantities were given by the other route. The administration of serum was not persisted in, as there was great doubt as to whether it had been beneficial. It was felt that drainage without replacement was the better treatment.

However, when the organism was isolated during the relapse, serum was again administered. It is very difficult to assess what share it took in his recovery. Later, hexamine in twenty-grain doses, alternated with alkalies, was given three times a day.

It was necessary to give hypodermics of morphia almost every night whilst the patient was gravely ill. Glucose, in the form of lemon drink, etc., was administered freely. An enema was given on alternate days throughout.

It is now six weeks since convalescence commenced. He looks and feels well, is up and about, and has gained most of his lost weight. His mental condition is in no way impaired. He has, in fact, apparently made a complete recovery.

I wish to pay tribute to the patience and skill of the nursing staff concerned, with particular mention of Sister Miss C. J. Macrae, Q.A.I.M.N.S.

My thanks are due to Lieutenant-Colonel M. F. Grant, R.A.M.C., Officer Commanding, Military Hospital, Catterick, for permission to forward this case for publication; and to Major W. Walker, M.C., R.A.M.C., and Captain A. T. H. Marsden, R.A.M.C., for their co-operation on the bacteriological side.

NOTES ON A SIMPLE METHOD OF STERILIZING CROCKERY.

By Captain M. F. GRIFFIN,

Royal Army Medical Corps.

The following notes are the outcome of two series of experiments, undertaken to test the efficiency of a common practical method used to clean and sterilize utensils in canteens and cook-houses, etc., as suggested by Colonel Cumming's article on Saliva-Borne Diseases, in the Journal of the Royal Army Medical Corps of February, 1931. This may form an important method of stopping the spread of these diseases.

After the experiments were carried out, an article appeared in the Journal of the Royal Army Medical Corps by Major T. O. Thompson (February, 1932) showing that all feeding utensils can be properly sterilized by heat, using downward displacement by steam. This method is obviously the ideal one, and far superior to any other.

The method tested by me consists of steeping the washed utensils in a 1 in 1000 solution of potassium permanganate for five minutes, or a two-minute exposure in a slightly stronger solution. While this is inferior in efficiency to the method of Major Thompson, it has the advantage of being simpler both to carry out and to supervise, and would appear to give reasonably good results.

Potassium permanganate was the disinfectant chosen, as its strength and purity can be estimated by sight, and therefore this method can be easily supervised by an intelligent N.C.O. When potassium permanganate is deviated by organic matter it becomes a browny-black. If it is not removed from vessels before use, it has no objectionable consequence. It also has the advantage of being cheap and easily obtained. It was noted that when permanganate solutions were too weak to kill the organism, the subsequent growth in broth was delayed, suggesting that it has an inhibitive action, lasting for some time after exposure. This was not noted when insufficient heat was used.

Series of experiments were at first carried out with the following organisms: *Bacillus diphtheriæ*, *Staphylococcus aureus*, *Streptococcus fæcalis*, *B. influenza* and *B. coli*; but it was soon found that any treatment which would kill *B. diphtheriæ* and *S. fæcalis* would kill the other organisms more readily, so that only these two were used during most of the investigations.

Experiments were made with organisms suspended in thirty per cent egg white, and it was found that these were very resistant indeed, particularly to potassium permanganate. Normal sputum was then tested and found to behave in a similar way to simple solutions, and had not the deviating effect of the albumin.

It should be remembered that the tubercle bacillus can be killed comparatively easily by heat, while it is very resistant to disinfectants, and will resist potassium permanganate in dilutions which would kill other non-sporing organisms. But while it is an organism to be guarded against in ordinary public restaurants, etc., it is not of such great importance in institutions used only by soldiers.

The experiments showed that the method of sterilizing glasses and cups by placing them on a perforated tray through which steam passed from an open boiler, a method sometimes used in India, was absolutely useless. The heat of the steam passing through the perforations varied with the temperature of the room, and was usually between 55° to 70° C. The apparatus used in these experiments should have been more effective than that usually employed, as it was smaller and deeper, and thus more protected from outside draughts; but it was found to have no disinfecting effect whatever.

In deference to the modern view that the dosage of organisms is a very important factor in infection, the benefit of washing in hot water cannot be over stressed. The importance of this is again emphasized when the buffer

effect of albumin is remembered. Thus, where a complete method of steam sterilization by downward displacement cannot be used, the method of first washing in hot water, and then leaving the utensils to stand in potassium permanganate 1 in 1000 solution is recommended. Ineffective methods of sterilization are dangerous, in that they give a false sense of security.

A considerable number of experiments were done in the Pathological Department of Trinity College, Dublin, and my thanks are due to Professor J. W. Bigger, who gave me the facilities for carrying them out, and for many helpful suggestions. I should also like to thank Dr. G. C. Dockery and Dr. L. L. Griffiths for their advice and help.

Echoes of the Past.

THE SECOND AFGHAN WAR, 1878-1879.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps (R.P.).

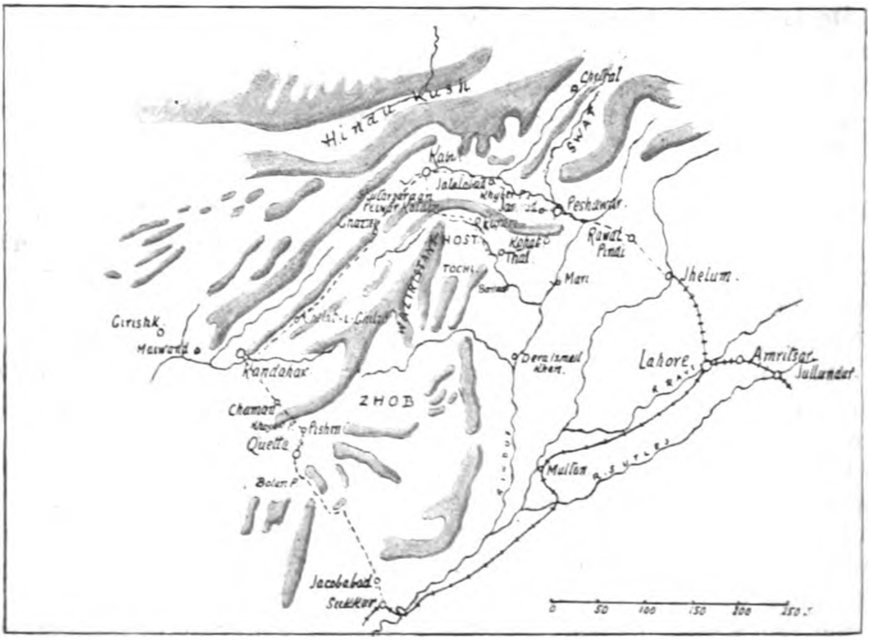
The immediate cause of the Afghan Wars of 1878-1880 was the reception of a Russian Mission at Kabul and the refusal of the Amir, Shere Ali, to admit a British one. War was declared in November, 1878, when three columns crossed into Afghanistan by way of the Khyber, the Kuram Valley, and the Khojak Pass respectively. The first column consisted of 10,000 British and Indian troops under Sir Samuel Browne, forming a division; the Kuram force, under Sir Frederick Roberts, was 5,500 strong; Sir Donald Stewart, operating through Quetta, had a division equal to the first. The Quetta garrison was reinforced to the strength of another division, and a second division of the Peshawar Valley Force was concentrated at Hasan Abdul.

The opening of the campaign was a time of much anxiety for the heads of the British Medical Service. Though the surgeons were technically no longer regimental, no steps had been taken to remove them from their corps, and there were no hospital establishments other than regimental.

In September, when the possibility of war was realized, Inspector-General Ker Innes had submitted an appreciation to the Commander-in-Chief in Bengal proposing the establishment of divisional field and base hospitals for British troops, the one to accommodate normally five, the other seven per cent of the force. While maintaining twelve per cent of beds as a whole, the proportion in each was capable of variation. Associated with this was a system of regular, if not daily, evacuation from front to base through rest stations where medical assistance and relays of transport would be provided. The hospitals were to be divisible into sections corresponding to brigades, and were to provide replenishment of medical stores

for the panniers of the medical officers, one of whom was to be attached to each unit.

The scheme, applying to British troops only, was accepted by the Commander-in-Chief, but final sanction was only accorded seven days before hostilities commenced. Surgeon-General Sir G. J. H. Evatt has described the confusion involved when the P.M.O., Deputy Surgeon-General J. Gibbons, arrived at Peshawar with a single copy of the *Precis*, as it was called, in the shape of a rough proof. "It became necessary in three days, and practically in the face of the enemy, to remove all the medical officers



and subordinates from their regiments to the little understood new creation of field hospitals, to hand over every grain of medicines, instruments and technical equipment, books and documents, and give and receive receipts on both sides, and finally to draw from the Commissariat, Ordnance, and Transport Departments the various equipments needed, the very existence of which was unknown outside the Medical Department."[1]

The P.M.O. was not allowed a staff officer. On one occasion he was seen leading his own camels, which he had drawn in person from the transport lines. It is not surprising that at the end of the second phase of the war he was sent home ruined in health and speedily died.

On November 20 a field hospital made up from regimental medical

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[1] *U.S. Journal of India*, 1890. JOURNAL OF THE ROYAL ARMY MEDICAL CORPS. vol. xx.

equipment was encamped with the division at Jamrud. The stores were packed in camel trunks, and the size of the tents precluded mule transport. As a result, when, on the following day, the force advanced on Ali Musjid, the hospital was left with the heavy baggage on the camping ground. The P.M.O. remained with it. That any effort was made to afford assistance to the attacking troops seems to have been due to the initiative of Surgeon-Major Evatt, who, later in the day, obtained leave from his Field Hospital Commander to follow them up with some reserve dressings and medical comforts carried in doolies. Arriving unescorted, and at no small risk, about nightfall, the party found that, though the main attack had been postponed, two Indian regiments had delivered a premature assault. Halting on the river bank, they received their casualties, numbering about fifty, and here they remained isolated through the night.

The main assault was never delivered, as the Afghans retired under cover of darkness. At dawn the Inspector-General, who had accompanied Army Headquarters, visited the dressing station, and arranged for the removal of the wounded to the Shirgai heights, whence they were transferred in doolies to Jamrud and afterwards by wheeled transport to the 300-bedded base hospital established under Surgeon-Major Fred Moore at Peshawar. In the evening the field hospital arrived and was pitched at Ali Musjid. On the 24th the division reached Dakka, where it remained three weeks. The hospital was again left behind, but on December 7 a section of fifty beds, under Evatt, with Surgeon Shaw and an apothecary (assistant surgeon) was moved up. In the meantime the only hospital accommodation on the spot was a hospital improvised by Surgeon-Major Creagh in the fort with his battery equipment. At the same time the evacuation scheme was put into practice. Elephants, camels and a reinforcement of doolies had come up from Peshawar, rest stations had been formed, and there was a daily evacuation through Landi Kotal and Ali Musjid to the base. Eventually the remainder of the field hospital arrived at Dakka and leaving a section behind in the fort, marched with the bulk of the division to a concentration area round Jalalabad.

By this time the cold of the Frontier had begun to affect the battalions who had come from warmer stations, especially those with a previous malarial history. A bad outbreak of pneumonia occurred in the 14th Sikhs who were sent back to India. Various small operations against the neighbouring tribes were undertaken both from Dakka and Jalalabad. Returning from one of these the 17th (Leicesters) had thirty-one cases of pneumonia and eleven deaths. The daily evacuation of weakly men continued, but the general health of the troops was described as good.[1] Towards the end of March the Second Division moved up and took over the line from Jamrud to Dakka. Surgeon-Major J. A. Hanbury was P.M.O. of

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[1] The average sick of British troops was given as 3·6 per cent and of Indian troops as 4·27 per cent.

this division, and Surgeon-Major J. H. Wright commanded the field hospital. At Peshawar a second base hospital was established under Surgeon-Major Ramsbotham. An Indian general hospital and an officers' hospital were also opened.

On April 2 occurred the disaster when an officer and forty-six men of the 10th Hussars were drowned in fording the Kabul river. Surgeon Cornish their medical officer narrowly escaped, only to meet his death two years later on Majuba Hill. On April 14 the division encamped at Safed Sang near Gandamak. On May 30, the Amir having died, the treaty of Gandamak was signed.

The operations on the Central and Southern routes now need consideration. General Roberts had a striking force of two infantry brigades, a cavalry brigade, two field batteries, two mountain batteries, and a company of Sappers and Miners with a squadron of the 10th Hussars. Two battalions and a field battery remained at Kohat. The P.M.O. was Deputy Surgeon-General F. F. Allen, C.B. A base hospital, described as "rough, but clean, comfortable, and orderly," was established under Surgeon-Major Curtiss Martin at Kohat.

Having opened a depot and a section of a field hospital at Thal, where the Miranzai and Kuram valleys meet, Roberts crossed the Kuram river on November 21. Going was easy, and all operations were facilitated by the friendliness of the Touri inhabitants. Marching on the right bank of the river by Khapianga, Ahmad-i-Shama and the Darwazai Pass, the Kuram Fort, near the present village of Ahmadzai, was occupied on the 25th, the Amir's forces retiring to a position on the Paiwar Kotal. The position was turned by a difficult and dangerous night march up the Spingawai Ravine and a somewhat critical fight at dawn, in which the 72nd and the 5th Gurkhas were particularly distinguished. The guns were carried on elephants. The troops engaged numbered 3,000, of whom 20 were killed and 72 wounded. The latter were removed to Kuram. The medical problem presented no serious difficulties. There was an efficiently organized transport service consisting of hired mules for the most part. In January, 1879, a column visited Khost, and was withdrawn after defeating the tribesmen at Matun. No further military operations were undertaken. The present road along the left bank of the river was made, hutments were built for the garrisons at Kuram, where there was a very complete hospital for British and Indians at the Peiwar Kotal, where there was another hospital, and at Ali Khel. The fort at Thal was strengthened and a new cantonment near Shalozan, the modern Parachinar, was commenced. Except for a few cholera cases at Thal, health remained good.

The railhead of the troops on the Southern line was at Sukkur on the Indus, and by no means the least arduous part of the undertaking was the long dreary march to Quetta through the desert and up the Bolan Pass, in which the heat by day and the cold at night tried the troops severely. As in the first Afghan War, the mortality among the camels was enormous.

Early in December the 2nd (Quetta) Division, having concentrated at Pishin, the 1st (Multan) Division began to reach Quetta, where they found the hospitals crowded. Partly owing to the scarcity of sweepers, and partly owing to the fatal omission to deal with the question early, the camping ground was in a deplorable condition, and the stench of dead camels filled the air. It was never really cleaned up, and remained a menace to health throughout.

The Multan Division, under the personal command of Lieutenant-General Sir Donald Stewart (P.M.O. Deputy Surgeon-General A. Smith), and the 2nd (Quetta) Division under Major-General Biddulph (P.M.O. Deputy Surgeon-General J. Hendley) advanced through the Khojak and Gwajha Passes. Each division had its British field hospital, and a base hospital under Surgeon-Major J. McCarthy was left at Quetta. In crossing the Khojak, the guns and wagons were lowered with ropes down a specially constructed ramp. Kandahar was reached almost without opposition on January 8. In the course of a reconnaissance made by the 2nd Division towards the Helmand River some cases of scurvy occurred, and a curious epidemic of giddiness, followed in some cases by insensibility, affected a number of the troops. Inquiry showed that among the crops the datura plant constantly grew, and was garnered with the wheat. To this the local inhabitants were immune, but the flour affected the Army with symptoms of poisoning by *Cannabis indica*.

When the treaty was signed at the end of May, the weather was already hot. The daily evacuation of sick to Quetta had for this reason ceased, and in March the base hospital was closed. A base hospital under Surgeon-Major J. B. C. Reade and a native hospital were operating in the citadel at Kandahar. Here the British troops remained healthy, but there was much pneumonia among the followers. As in the First Afghan War, jaundice was prevalent. It was decided in view of the season that the march back to India must be postponed until the autumn. The troops in the Kuram also remained. The problem of the withdrawal from Gandamak was one which required the most serious thought. A conference at which Inspector-General Ker Innes and Dr. Cunningham, the Sanitary Commissioner, were present, was held by the Governor General at Simla. An outbreak of cholera had occurred at Peshawar. In spite of the precautions, such as examining posts and cholera hospitals, adopted by the P.M.O. of the 2nd Division, it had spread to Ali Musjid, and on May 15 had reached Jalalabad. There was reason from past experience to believe that the division, if it remained at Gandamak through the summer, would suffer severely from dysentery and enteric fever, cases had indeed already occurred. Moreover they had no shelter other than tents. Under the circumstances it was decided to move in. Every possible precaution was taken, excepting only those comparatively simple and vital ones, which later knowledge has taught us might reasonably have been expected to preserve at any rate the disciplined portion of the force from infection. Surgeon-Major J. H.

Porter, a most experienced and popular officer, was attached to the Quartermaster-General's Department to advise on camping sites, preservation of water supplies and sanitation of camps and rest depots. Recommendations were made as to troops marching in the evening, the provision of double-fly E.P. tents, avoidance of old camping grounds, easy marches and the issue of refreshments. The British field hospital was split into its four sections and distributed among the marching detachments.

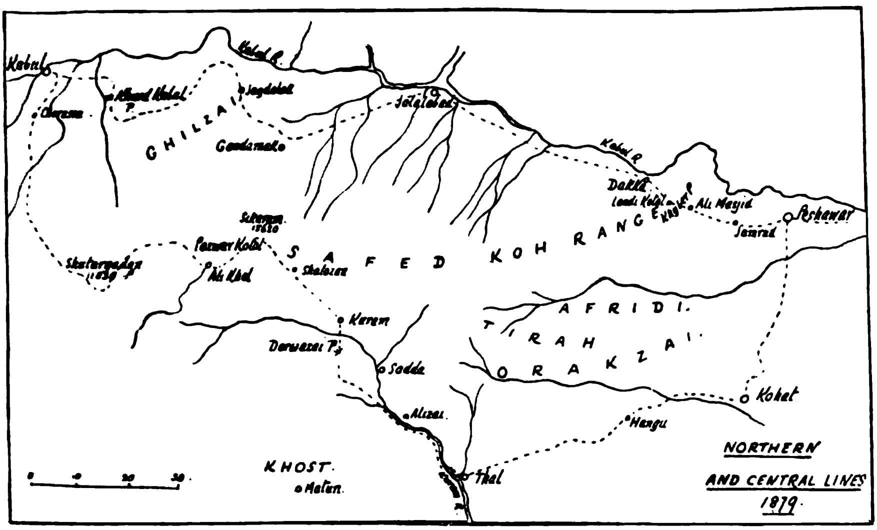
No doubt the measures taken were of considerable value, but the death roll was heavy. The Rifle Brigade had forty-seven deaths from cholera before reaching Peshawar, the 10th Hussars thirty-four, the 51st thirteen, and the 17th nine. Of the Indian regiments, the writer has found no record. The stores from Jalalabad were floated down the river on rafts, and with them a number of Indian cholera patients. The troops commenced their march in poor condition. The temperature rose to between 110° F. and 115° F. "On reaching Jamrud," Inspector-General Innes wrote, "their distress was very apparent. Their clothes were stiff and dirty from the profuse perspiration and dust; their condition betokened great nervous exhaustion combined with a wild expression difficult to describe, the eyes injected and even sunken, a burning skin, a dry tongue, a weak voice, and a thirst no amount of fluids seemed to relieve. . . . If there was one class worse than another it was certainly the medical officers and subordinates." Surgeon-Major Porter states that on their arrival at Hari-Singh-Ka-Burj most of them were in a painfully helpless and prostrate condition both mentally and bodily. This was attributable to the strain to which they had been subjected, almost incessant work day and night coupled with the anxiety and depression, which even the most indifferent or callous must share in the presence of so much disease, fatigue, and responsibility. Some had almost literally no relief from toil, as from so many of their number becoming ill the duties became doubled and trebled for those who remained at their posts. The M.O. i/c Section Hospital broke down early, next the surgeon of the 4th Rifle Brigade, and a third Medical Officer arrived at Hari-Singh who was simply capable of handing over his sick before being placed himself on the sick list. The medical officers had been thrown entirely on their own resources in regard to pitching and striking of tents, receiving no European assistance for this purpose. They had also to muster the doolie-bearers before marching and drive them like so many cattle along the march. Others not entitled to draw forage allowance were obliged to march on foot, and at the end of it to perform their professional duties when worn out by fatigue and excessive heat. While the troops were passing through Peshawar there were twelve medical officers on the sick list at one time.

Up to the end of June, 317 cases of cholera and 199 deaths were reported. There were four deaths among the medical staff during June and July, of which two were from cholera. The officers who took part in this march were, besides Gibbons the P.M.O., Surgeon-Majors J. H. Porter,

H. Cornish, J. F. Supple, G. J. H. Evatt, J. E. Fishbourne, A. H. Rattigan, and Surgeon H. Charlesworth, the last six with the field hospital sections.

The war was now assumed to be over, though it proved to be no more than the termination of the first phase. The Commander-in-Chief bore handsome testimony to the conduct of the medical officers in the cholera epidemic. The divisional P.M.O.'s. were mentioned in Dispatches as well as seventeen others of the A.M.D. and six regimental medical officers of the Indian Army.

As usual, many valuable lessons had been learnt or relearnt. A certain proportion of the British battalions were composed mainly of long service men. These were found to have borne the strain of active service well. A large number of the younger soldiers enlisted under the recent conditions



of six years with the Colours and six with the Reserve had broken down. After the war, the term was altered to seven and five. The disastrous wastage resulting from the despatch of troops to the frontier from unhealthy, especially malarious, stations was brought to notice by the Inspector-General. The mortality among followers from pneumonia owing to their being inadequately clothed was appreciated, and, for a time, taken to heart. The need for a disciplined Army Hospital Corps, a properly organized cadre of native bearers, and the attachment of British nursing orderlies to the field hospitals, was strongly represented. The new system of field hospitals for British troops and continuous evacuation through relay posts were accepted as having justified its trial. The divided system under which the Indian regiments took their regimental hospitals into the field had caused some confusion, but less than was expected. The supply of portable field medical equipment was taken in hand and satisfactorily dealt with. After some difficulties, the proposal that sick transport should

be ear-marked as such and remain under the orders of the P.M.O. of the force was accepted in principle.

On July 24, in accordance with the terms of the treaty, Sir Louis Cavagnari arrived at Kabul as the British representative. His staff consisted of his secretary Mr. Jenkins, Dr. A. H. Kelly of the Indian Medical Service and Lieutenant W. H. P. Hamilton in command of a carefully picked escort of twenty-five Guides Cavalry and fifty Infantry of the same Corps. On the morning of September 3, the Residency, which was within 250 yards of the Amir's palace in the Bala Hissar, was attacked by three Afghan regiments. The escort held out with the utmost gallantry until evening, when they were overwhelmed, the survivors either perishing in the burning building or being put to the sword.

Immediate action was decided on; the evacuation of Kandahar, which had already commenced, was arrested. The Shutargardan Pass on the Central Line was occupied by British troops, and Sir Frederick Roberts hastened down from Simla to resume command of the Kuram Field Force, the strength of which was now about 7,500, including in its ranks the 9th Lancers, 2nd battalion 8th (Kings Liverpool), 72nd (Seaforth) Highlanders, 85th (2/K.S.L.I.), and 92nd (2/Gordon) Highlanders. The transport consisted mainly of mules. Profiting by past experience, a suitable scale of warm clothing had been supplied; for British, a jersey, warm socks, mittens, putties (on payment), Balaklava caps, and poshteens. Indian troops had the same, but a blanket in place of a jersey. For followers, a country blanket and warm pyjamas were allowed, and either a poshteen or a warm coat.[1] The uselessness of the Indian shoe was pointed out by the General on reaching Kabul. He suggested the substitution of a Kabali pattern one, but stated that the only effective footgear for Indian troops on the frontier was the ammunition boot. The Government price of a pair was 4 Rs. A serious effort was made to organize the Kahars, who were put under the charge of a medical officer, Surgeon-Major Isidore Burke. The field medical equipment was now all in mule panniers.

On September 27th Headquarters moved from Ali Khel to Shutargardan. In a skirmish with some tribesmen, *en route*, Deputy Surgeon-General Townshend, I.M.S., the P.M.O., who was riding with General Roberts, was severely wounded, receiving a bullet in the jaw. At Kushi the Amir Yakub came into the British camp, professedly to place himself under British protection. He was under the gravest suspicion in connection with the murder of the Envoy and was detained. On October 5 Chaharasia was reached, where the column bivouacked at a point eleven miles from Kabul. On the following day a force of 10,000 of the enemy was engaged with decisive success, and on October 9 Kabul was occupied.

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[1] The so-called "warm coat," by the year 1918, had degenerated into the miserable "coat, warm, followers" which was supplied for some time to the newly formed Army Hospital Corps.

Roberts's troops in this engagement numbered 3,800,[1] the action lasted eight and a half hours, and his losses were eighteen killed and sixty-seven wounded. Among the latter was Surgeon A. Duncan of the 23rd Pioneers. Surgeon J. J. Morris, attached to the 92nd, received a mention in Dispatches. On reaching Kabul the Amir abdicated, and was later despatched to India. Meanwhile the posts at Shutargardan and Ali Khel were attacked by 10,000 Ghilzais. The garrisons were relieved, but, as the winter was closing in, this line of communication was abandoned and the Khyber line re-opened by the 2nd Khyber Division from Peshawar under Major-General Bright. The P.M.O. with this force was Deputy Surgeon-General H. B. Hassard.

Roberts with his small force maintained a continuous and energetic offensive, but just before Christmas he was compelled to withdraw into his fortified cantonment of Sherpur while the city of Kabul was occupied by 20,000 Afghans. A strong attack delivered on December 23 was handsomely repulsed, after which the Afghans dispersed. Our casualties from the enemy during the fortnight's fighting did not exceed 280. Pneumonia was now very prevalent. During the first week of the New Year Surgeon A. C. Keith died of the disease, and three days later Deputy Surgeon-General J. H. Porter, who had succeeded as P.M.O., also succumbed. This officer, to whom the General paid a fine tribute in column orders, had served in the Crimea and the Mutiny and held the German " Steel Medal " for his work in the British Ambulance at the siege of Paris.

In March, Sir Donald Stewart moved towards Ghazni with two divisions, Kandahar being taken over by Major-General Primrose with a division of Bombay troops. On April 19, Stewart, with 4,651 men, engaged and defeated 15,000 Ghilzais and Duranis at Ahmad Khel, inflicting a loss on the enemy of 3,000. It was one of those comparatively rare events, a hand-to-hand fight. Successive waves of swordsmen on foot charged our infantry and up to within thirty yards of the muzzles of the guns. The British reserves were all thrown in, the situation, at one time critical, being saved by repeated charges of the Punjab Cavalry. Our casualties, seventeen killed and 125 wounded, were all caused by knife and sword cuts. Sir Donald Stewart now assumed command of the three divisions of what became officially the Northern Afghanistan Field Force. The medical staff was as follows: P.M.O., Deputy Surgeon-General A. Smith, C.B.; 1st Division (Roberts), Deputy Surgeon-General H. B. Hassard; 2nd Division (Ross) Deputy Surgeon-General J. A. Hanbury; 3rd Division (Hills), Brigade Surgeon R. W. Meadows.

In March pneumonia disappeared. The field hospitals of the 1st and 2nd Divisions were amalgamated into one large field general hospital with

[1] Squadron 9th Lancers, three regiments Indian Cavalry, two batteries R.A. and a Mountain Battery, wing of 67th, 72nd and 92nd Highlanders, 5th Gurkhas, 5th Punjabis, and 23rd Pioneers.

Surgeon-Major S. B. Roe in charge of the British, and Surgeon-Major G. Farrell, 5th Gurkhas, of the Indian Section. On the restoration of the Khyber line, daily evacuation of sick through relay posts had been established. This system, which was economical in transport and saving of Kahars, was in March replaced by one of large weekly convoys, from which the bearers returned sick and exhausted. In April the heat rendered movement of any serious cases undesirable. During the next two months the troops on the Khyber Line were kept in constant activity by Mohmand, Khugiani and Shinwari raids. Kuram was, on the whole, quiet. Here the lower valley was becoming malarious.

In July the Kandahar Province was threatened by the advance of Ayub Khan, the ex-Amir's younger brother, from Herat, and the tribes rose in sympathy. The Wali of Kandahar with an Afghan force was sent to oppose him, and a force of all arms, under Brigadier-General Burrows, moved out in support.[1]

The force was accompanied by a field hospital in charge of Surgeon-Major J. D. Edge, Surgeon-Major A. F. Preston was in medical charge of the 66th (2/Royal Berkshire) Regiment, C. H. Harvey of the Artillery, and Surgeons Burroughs, Dane, and Eaton of the I.M.S. accompanied their respective corps. Burrows advanced to Girisk, when the Wali's troops all went over to the enemy. He then fell back, encumbered with a good deal of baggage and eighty-four sick, to a point forty-six miles from Kandahar. On the morning of July 27, having received information that the enemy were occupying the village of Maiwand in force, though in unknown strength, he decided to attack. The artillery came into action and the infantry came up in line with the guns, but here they were halted and remained. The field hospital and transport were three-quarters of a mile in rear with a baggage guard. The Afghans, emboldened by seeing the British halted, commenced to attack. The infantry stood their ground for three hours, the small force of Indian cavalry being employed in constant demonstrations against the Afghans, who threatened to envelop our flanks. The baggage guard was in action from the first. The troops had been out since 7 a.m., they had no cover, the temperature was 110° F. in the shade. At about 3 o'clock the Ghazis got close in, the Indian infantry on the left suddenly broke, and rolled up on the 66th, forming a helpless crowd of panic-stricken men. A cavalry charge was ordered, but the men had had as much as they could stand, and, after one effort, went about without orders and retired off the field. The main body of the Berkshires retired in good order, continuing to inflict great loss on the enemy. A halt was made in an enclosed garden, where the entire Afghan army surrounded them. Here, rallying round their colours, and fighting to the last,

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[1] 66th (2/Royal Berks), 30th Bombay Infantry, 1st Bombay Grenadiers, Company Bombay Sappers and Miners, 3rd Bombay Light Cavalry, 3rd Sind Horse, E-B., R.H.A., and a captured smooth-bore battery.

Lieutenant-Colonel Galbraith with nine of his officers and more than half his men died.

The baggage and hospital guard, consisting of a company of each of the three infantry battalions under Major Ready of the 66th, had put up a fine defence throughout. A little time before the débâcle occurred, an attempt was made to withdraw the baggage. This failed, but the majority of the sick, and those of the wounded who had reached the hospital, seem to have been got away on transport animals. When the Bombay Infantry broke, a general panic occurred among the followers in rear. Surgeon-Major Preston, who had just been brought in wounded, was carried off by his doolie-bearers at a run, amid a stream of men, camels, bullocks and horses stampeding in confusion. He was soon dropped, but was fortunately taken up by an artillery wagon, and so escaped. The other medical officers were equally fortunate, but fourteen of the Kahars were killed. In spite of the gallantry of the Royal Artillery, eight guns had to be left; their limbers went out of action crowded with wounded. The pursuit was not pressed, as the bulk of the Afghans were engaged in looting the baggage. The remnant of the force, a straggling column upwards of six miles long, had to cross sixteen miles of desert before water was found. The number engaged was 2,476. Of these 21 officers and 296 British other ranks were killed and 8 officers and 42 other ranks wounded. Of the Indian troops, 653 were killed, and 118 wounded were brought in; of the followers, 331 were killed or missing. Surgeon-Major Edge received a mention in Dispatches. Whether or not the attack against vastly superior numbers might have succeeded if properly pressed, depends no doubt on various purely military considerations, but one may conjecture that General Roberts, who appreciated the Afghan temperament, would have carried it through. The Indian regiments present were, at the lowest estimate, of good average quality, but the strain of the long passive resistance when hungry and exhausted by heat was too much for them.

When the news of the disaster reached Kandahar the cantonment was hurriedly abandoned, and the troops were withdrawn into the city, which was soon closely invested. General Primrose had about 5,000 men, of whom 438 were on the sick list. The British force consisted of the 7th Royal Fusiliers, the remains of the 66th, and three batteries. A hospital was established by Deputy Surgeon-General J. O'Nial in the citadel. A sortie made on August 16, in which a loss of 106 killed and 117 wounded was incurred, did nothing to improve the morale of the garrison. There was much sickness, ascribed to want of fresh vegetables, the confined quarters and the difficulties of conservancy with the enemy close under the walls. The siege continued until the 23rd, when the Afghans withdrew on the approach of the relieving force.

On August 8, 2,562 British and 7,151 Indian troops, with 18 mountain guns and mule transport, left Kabul on their 300 mile march to relieve Kandahar. Sir Frederick Roberts's advance through hostile country without

a base or communications towards a point presumably in possession of a recently victorious enemy was, until justified by its success, condemned by military critics as in complete disregard of all accepted principles. The distance was covered in twenty-three days.

The force was most carefully selected, all weakly men being discarded. Deputy Surgeon-General J. A. Hanbury was P.M.O. of the column, with J. Ekin P.M.O. of the infantry division. A section of a field hospital was allotted to each brigade for British troops, to which was attached a subsection for followers. The Indian troops, as usual, had their regimental hospitals. For sick transport there were 2,192 Kahars, 115 doolies, 321 dandies, 286 ponies, 43 donkeys, 3 bullocks, and 6 camels, calculated in the proportion of 5 per cent for Europeans, 3 for Indian troops and 1½ for followers. This scale was, however, inadequate. The Kahars started in bad condition, many of them having recently returned from heavy duty with convoys.

The country to be traversed consisted of valleys cut by deep nalas or plains mapped out in little patches, signs of former cultivation, bounded by ridges and irrigation channels. This made very bad going. The daily variation of temperature was as much as 80° F.; sandstorms and the dust of the column caused much discomfort. As regards rations, good mutton was usually secured by the supply officers, flour was baked in a field bakery. The difficulty of fuel was overcome by digging up the roots of the southern wood (abrotanum) or by purchasing the houses of the villagers and burning the roofs. Water, though good, was scarce, and halts had to be regulated accordingly.

Ghazni (97½ miles) was reached in seven marches, in the course of which the Zamburak and Sher-Daban Passes were crossed. Blistered feet, dyspepsia with bilious vomiting, and diarrhœa caused some trouble. Three sepoys died from intestinal obstruction, having consumed large quantities of water after a meal of raw Indian corn. Many of the marching boots were coming to pieces, and it was found necessary to augment the sick transport by the purchase of a large number of donkeys. The next 136 miles to Khelat-i-Ghilzai were completed between August 16 and 23, the average constantly sick for the first seven days being 550 troops and 200 followers. Half this inefficiency was due to sore feet. On the 23rd the first halt was made; 232 miles had been accomplished in 14 marches. From Khelat to Khel-i-Khun (50 miles) took three days, when another halt was made, the sick and weakly men being sent on to Robat, the next halt, in two stages. Kandahar was reached without cpposition on August 31, when about 1,000 men suffering almost entirely from minor ailments were admitted to hospital. The last 20 miles of the journey had been done in 2 short marches after a halt. The official history of the campaign estimates that 280 miles were covered in twenty days or 19 marches.

Sir Frederick Roberts was not favourably impressed by the bearing of the greater part of the garrison, which he described as demoralized and despondent. The force which he now had at his disposal actually out-

numbered that of Ayub Khan, who had taken up a position among the hills on the Baba Wali Kotal. On September 1 an attack was delivered with 8,392 men when the Afghans were thoroughly defeated and their army broken up. During the fight the field hospital remained in camp, dressing stations and ambulance transport accompanying the brigades under the brigade surgeons. Our losses were 35 killed and 213 wounded. A few days later the advanced troops of a fresh division from Quetta under Major-General Phayre arrived.

The following medical officers took part in Roberts's march and the victory of Kandahar: *British Service*, Deputy Surgeon-Generals: J. A. Hanbury,[1] J. Ekin; Surgeon-Majors: E. Hopkins, W. F. Bennet, G. McNalty,[1] E. C. Markey,[1] R. Lewer,[1] S. B. Roe,[1] J. Oughton, H. Cotton, J. Brodie, J. A. Atkins[1]; Surgeons: E. H. Fenn,[1] W. F. Trevor, A. W. Mackenzie. *I.M.S. Officers*, Surgeon-Majors: W. Finden,[1] D. F. Keegan, G. C. Chesnaye,[1]; Surgeons: H. J. Linton,[1] J. A. Nelis, W. Coates, J. Muldane, W. Palmer, J. Duke, A. Hamilton.[1] Deputy Inspector-General J. O'Nial, Surgeon-Major B. T. Giraud, and Surgeon-Major J. Arnott of the I.M.S. were mentioned in Major-General Primrose's Dispatches for the siege of Kandahar.

General Roberts's victory had the immediate effect of quieting the country. Abdur Rahman had already been recognized by the Indian Government as Amir. By the end of February, 1881, the Kuram Valley was evacuated; in March the last troops left the Khyber, and in April the troops in Southern Afghanistan had returned to the Quetta district. The final withdrawal from Kandahar was admirably conducted; rest camps, water supplies, and shelter were carefully arranged, and in spite of the heat the health of the troops was excellent.

The maximum strength attained by the British armies in Afghanistan during this war was in August, 1880, when there were 18,801 Europeans and 46,151 Indians engaged. The average strength of British troops of the Bengal Army during the seven hundred and ten days has been given officially as 10,246. Of these 1,122 died, including 161 killed in action or died as the result of wounds, making an annual death-rate of 56·2 per 1,000. The admissions to hospital are given as 1,443 per 1,000 per annum, which compares favourably with that of 1,911 for all India during 1879. These figures do not apparently include some 2,000 odd Europeans of the Bombay Division in General Primrose's force. These suffered much from sickness during their stay in Kandahar; lost 317 at Maiwand and 32 more in the sortie of August 16.

The following medical officers lost their lives: Deputy Surgeon-General J. A. Porter; Surgeon-Majors: R. H. Bolton, G. Atkinson, J. H. Wright, H. Kelsall; Surgeon A. C. Keith, of the British Service; Surgeon-Major J. Wallace; Surgeons: H. A. C. Gray, G. Watson, J. E. Walsh, A. H.

[1] Mentioned in Dispatches.

Kelly and W. B. Smyth, of the I.M.S. Kelly was killed in the attack on the Kabul Residency; Smyth was killed by robbers at Chapri.

Though examples of failure and omission were not lacking, the attention paid to sanitary detail was a marked feature of the war. The Q.M.G. staff, as a whole, had by now recognized disease prevention as part of their work and collaborated with the sanitary officers who were appointed in every column. An important feature in the care of the sick was the complete suppression of the British troops regimental hospitals. The adoption of a regular daily evacuation through relay posts, whenever possible, in preference to the convoy system, was in accordance with our modern methods of keeping the front clear. The organization of the Kahars into a military body was one of the results of the experience of the war.

Current Literature.

NAPIER, L. E., and DAS GUPTA, B. M. **Atebrin: A Synthetic Drug for the Treatment of Malaria.** *Ind. Med. Gaz.*, 1932, lxvii, 181.

The writers received a supply of atebrin from the manufacturers and tested its action in Calcutta on eleven cases of malaria, in two of which the parasite was *P. malariæ*, in three *P. vivax*, in five *P. falciparum*, and in one both *P. vivax* and *P. falciparum* were present.

The dose of atebrin in adults was 0·1 gramme, in tablet form, given three times a day for four days.

Fever was controlled by the drug, the temperature finally falling after an average of 5·25 doses.

By thick film examination no asexual forms of parasite were found after the fifth day, the mean of all the cases being 3·6 days. But by the cultural method of examination the earliest date of disappearance of asexual forms was the sixth day and the latest the twenty-first.

The writers considered that the drug had no action on sexual forms—at any rate on those of *P. falciparum*. Crescents appeared in one case after the completion of the course of atebrin.

No toxic symptoms were produced by the drug and no patient complained of the taste of the drug or of ill-effects.

STRICKLAND, C., and ROY, D. N. **The Behaviour of Plasmodia in the Mosquito after Treatment of the Human Host with Atebrin.** *Ind. Med. Gaz.*, 1932, lxvii, 191.

The writers, working in the School of Tropical Medicine, Calcutta, examined the blood of a Mahommedan male suffering from malignant tertian malaria and found 24,600 trophozoites per cubic millimetre of blood.

The man was then placed on 0·1 gramme atebrin three times a day for

four days. On the third day of treatment blood examination revealed the presence of 2,320 parasites per cubic millimetre, and there were a few crescents among the parasites.

On the last day of treatment two hundred crescents per cubic millimetre were seen, and on this day ten female mosquitoes (*Anopheles stephensi*) were allowed to feed on the patient. The mosquitoes were left under suitable conditions, and were dissected from the twenty-first to the twenty-fourth day after feeding. No developmental forms of the malaria parasite were found in the mosquitoes.

The day after treatment was stopped twenty-three *A. stephensi* were fed on the patient, when there were 160 crescents per cubic millimetre of blood. The mosquitoes were dissected from the twenty-second to the thirty-first day after feeding, and five were found to show developmental forms of the parasite.

Finally, on the third day after atebrin was stopped, nine *A. stephensi* were allowed to feed on the patient who, on the following day, showed 120 crescents per cubic millimetre of blood. On being dissected from the nineteenth to the thirtieth day all the mosquitoes showed developing forms of the malaria parasite.

The writers state that as the result of the above investigation, there is a strong presumption that atebrin administered to a patient suffering from malaria completely prevents the development in the mosquito of any gametocyte from that human host, that considerable inhibition to development exists the day after the drug has been discontinued, and that the parasite resumes its developmental powers three days after the discontinuance.

BURDON, K. L. **Use of Plasma in Precipitation Tests for Syphilis.** *American Journ. of Syphilis*, 1932, xvi, 237.

While seeking for a method of obtaining results of flocculation tests for syphilis as speedily as possible, the writer, on the suggestion of Dr. Bronfenbrenner, investigated the use of plasma instead of serum in the Kline and Kahn tests.

To obtain the plasma $\frac{2}{5}$ c.c of a ten per cent solution of sodium citrate was placed in a test-tube, which was marked with a grease pencil at the 4 c.c. level. Blood from a vein was run into the tube up to the 4 c.c. mark. Where it was not convenient to withdraw about 4 c.c. of blood, as is the case of small children, 0·1 c.c. of the citrate solution was placed in a tube and blood was added up to a mark at 1 c.c. The concentration of sodium citrate was thus 0·1 per cent, and it was found that higher concentrations were unsuitable as they tended to give false-positive or partial-positive reactions.

On the addition of the blood the test-tube was shaken and its contents were then centrifuged for two minutes, or, if the test was not to be performed at once, the test-tube was allowed to stand upright till the blood cells settled down. The plasma was pipetted off, heated at 56° C. for ten

minutes and was again centrifuged for two minutes. The clear plasma was then drawn off and was ready for the test.

Several batches of fifteen or more patients were tested by Kline's "sensitive" and "very sensitive" antigens while they were in the clinic and, with the help of an assistant, the writer was able to complete the duplicate tests in an average time of six minutes per specimen. The total time from the withdrawal of blood to the giving of the final report was about thirty minutes.

Kline tests and Kahn tests were performed on sera and on plasma, in 328 cases both tests being performed with the sera and with the plasma of the patient, and the writer concludes that the tests with plasma are rather more sensitive than the serum tests.

Reviews.

THE MEDICAL ANNUAL, 1932 (JUBILEE VOLUME). Edited by Carey F. Coombs, M.D., F.R.C.P., and A. Rendle Short, M.D., B.S., B.Sc., F.R.C.S. Bristol: John Wright and Sons, Ltd. 1932. Many text illustrations and 81 plates, plain and coloured. Pp. c + 676. 20s. net.

The 1932 edition signalizes the Jubilee of this Annual which has for many years now become quite indispensable to physician and surgeon alike.

The volume remains unchanged in the arrangement of its many useful features. As regards the sections dealing with medicine we can only refer briefly to a few of the articles of particular interest to members of a Service much of whose work is in the realm of tropical affections.

Recent work in trypanosomiasis is reviewed by Rogers, and we commend to our readers' notice the encouraging experimental results obtained by York and Murgatroyd working with trivalent arsenical compounds. Of more than passing interest is the demonstration by Holawani of the development of an emetin resistant quality by *Entamœba histolytica* when emetin is exhibited in gradually increasing doses over a long period. We are so familiar with the clinical failure of this drug in association with its gross misuse as regards dosage that some definite scientific explanation of such failures has long been overdue and is now all the more welcome if finally confirmed.

As regards the serum treatment of bacillary dysentery there appears to be little in Lautru's American results with which the average physician in the tropics was not thoroughly conversant at least fifteen years ago.

As to malaria the position as regards control and treatment is making such rapid strides that the work reviewed in this Annual is scarcely up to date. The newer methods of plasmoquine exhibition and their very great importance have not yet come under review although they have

been applied on a large scale in Army medical practice in India for the past two years.

With regard to the surgical section of the book the wealth of material is so great that it is difficult to select special contributions for review.

A very wide field is covered and the subjects have been very carefully selected to be of the greatest assistance to those seeking help in special cases, and the list of distinguished contributors is a guarantee of the value of the articles.

.Throughout the work the avoidance of extravagant claims for any method of treatment which is still *sub judice* is specially to be commended, and the pros and cons are fairly presented.

The use of maggots in the treatment of infected wounds is interesting, but for obvious reasons is unlikely to be widely adopted by surgeons.

The section on the parathyroid glands gives a good summary of the present state of knowledge of this subject and is equally interesting to physician and surgeon.

The article on post-operative complications, while not all new, is well worth study by young surgeons and practitioners who may have to be responsible for the after-care of cases following operation.

While the radium treatment of cancer is correctly confined to specialists on the subject, the article by Mr. Stanford Cade gives excellent guidance to the practitioner as to how much can be expected from this method of treatment.

The contribution on X-ray diagnosis brings this subject well up to date.

The section on pharmacy and appliances is always a useful feature of the work and is well up to the standard of previous editions.

There can be no doubt that the Medical Annual fulfils a very useful purpose. Taken up in spare moments there is always something of interest to be found, and in difficult cases help will often be forthcoming when standard textbooks fail to throw any light on the subject.

No other publication gives within the same compass such a wealth of new material in all departments of medicine and surgery. It can be strongly recommended as an addition to the library of every doctor.

J. W. W. and J. H.-S.

Report of the Surgeon-General of the United States Army for the year ending June 30, 1931. Washington : Government Printing Office. For sale by the Superintendent of Documents, Washington, D.C. Pp. xiii + 434. Price 60 cents.

The report begins with an extensive summary by the Surgeon-General in his " Letter of Transmission."

The medical statistics dealt with are those for the calendar year 1930, during which the military personnel of the Army had an average daily strength of 137,299, this being an increase of 1,239 over the strength in 1929.

The annual sick admission rate for 1930 was 608 per 1,000, which is the lowest figure ever recorded, the next lowest figure having been 614 in 1919.

The main causes of admission during 1930 were bronchitis, gonorrhœa, acute tonsillitis, athletic exercises and chronic tonsillitis.

Amongst the white enlisted men the highest sick-rate was in China, then came Panama, the Philippine Islands, the United States and Hawaii.

There were 533 deaths, giving an annual death-rate of 3·88 per 1,000, as compared with 4·34 in 1929.

The lowest death-rates recorded are 3·77 in 1925 and 3·83 in 1924. The Surgeon-General states that if it had not been for a considerable increase in the number of deaths from automobile accidents in 1930 the mortality figure would have been the lowest on record. There were seventy-two deaths from automobile accidents as compared with forty-six in 1929.

The chief causes of death were automobile 72, suicide 41, tuberculosis 33, drowning 31, cancer and other malignant tumours 26, appendicitis 25, lobar pneumonia 23, chronic nephritis 22, airplanes 22, homicide (not including deaths from "shot by sentry") 12.

The number of discharges for physical and mental disability decreased from 2,395 in 1929 to 2,130 in 1930, but there were fewer first enlistments in 1930 than in previous years and the rate of discharge was highest during the first year of service, 47 per cent of all discharges being in that period.

The average daily non-effective rate in 1930 was 30·9 as compared with 31·3 in 1929 and 30·2 in 1928, the chief causes being gonorrhœa, tuberculosis, syphilis, athletic exercise and automobiles.

The admission-rate for venereal diseases was 47·7, which is the lowest yet recorded; but these diseases accounted for 7·9 per cent of all admissions to hospital and quarters and 16·3 of the total loss of time on account of sickness. The Surgeon-General states that the rate of admissions for venereal diseases has been reduced by 73 per cent since 1909, when a campaign against these diseases was begun. In 1923 the War Department issued an Army regulation "which for the first time put the question of the responsibility of the prevention of this class of infection where it belongs, that is on the organization commander." Since then the ratio for venereal diseases has steadily declined. In one corps the area surgeon stated that the venereal rates were still too high, due in most cases to excessive rates in a few companies, and he attributed this to "indifference of a few organization commanders, with apparent indisposition on the part of some superiors to bring pressure to bear upon them or to use drastic measures." Concerted action in Hawaii reduced the venereal rate there to 20 new cases per 1,000, the lowest point ever recorded in the Army for white troops; but in China the annual rate was almost 300 per 1,000.

Injuries were only about half as numerous as they were just before the

Spanish-American war, although automobile injuries helped to keep up their number. This fall is attributed to the great decrease in the alcoholic rate.

The daily average number of patients in hospital was 6,815.

The cost per patient day in general hospitals in the United States was 5·07 dollars, made up as follows: Pay and allowances of officers 1·03 dollars; pay and allowances of nurses 0·55 dollar; pay and allowances of enlisted men 0·78; pay, etc., of civilian employees 0·75; subsistence of sick in hospital 0·73; laundry 0·13; blood transfusion and specialists' treatment 0·005; medical supplies and equipment 0·51; utilities 0·27; maintenance and repair 0·31.

Candidates for the Military Academy are very carefully examined before admission. Cadets in the Academy are carefully supervised and before receiving a commission they are again examined. Each year every officer is submitted to a thorough physical examination and any defects are treated. The result of this care is that officers have a higher expectation of life than their age-equals in civil life. This higher expectation rate varies from two years in the 21-61 age-period to just over one year at the age of 81.

The number of medical officers at the end of June, 1931, was 966, which was practically the full establishment, there being seventeen vacancies which were filled later. It is not anticipated that there will be any difficulty in filling vacancies as they arise. However, the Surgeon-General states that the number of officers is insufficient for the amount of work they are called upon to perform.

The Army Medical Centre at Washington is under the command of a Brigadier-General, and in it are the Army Medical School, the Army Dental School, the Army Veterinary School and the Army School of Nursing; the Walter Reed General Hospital of 1,000 beds is also in the same reservation. Summaries of the work of these institutions are given in the report.

Sixty-four officers of the Medical Corps carry out the medical duties at the flying fields of the Air Corps. These officers are qualified flight surgeons.

Two officers of the Medical Corps do duty with the Chemical Warfare Service, one being medical adviser to the Chief of the Service and the other is in charge of the medical research division at Edgewood Arsenal.

There is a shortage in the number of dental officers which leads to much dental disease being untreated. A minimum of one dental officer for 500 men is aimed at.

The Veterinary Corps is a division of the Medical Service of the United States Army, and one of its duties is the inspection of all meat and meat products supplied to the Army as well as dairy inspections and milk analyses. Details of the work of the Veterinary Corps during the year are submitted in the report under review.

RESEARCHES IN BLACKWATER FEVER IN SOUTHERN RHODESIA. By G. R. Ross. Published by the London School of Hygiene and Tropical Medicine, 1932, and printed by John Bale, Sons and Danielsson, Ltd. Pp. viii + 262. Cloth 10s. 6d. Paper 8s.

This monograph forms No. 6 in the memoir series of the London School of Hygiene and Tropical Medicine.

The author contributes to the literature of tropical medicine the results of a most valuable and exhaustive study of blackwater fever. Shortly it may be said that the main value of his work lies in the confirmation or otherwise (from a large number of chemical and ample clinical observations) of many of the theories already advanced by other workers, which have rested hitherto on but little actual evidence. Thus the work covered includes factors such as the "pre-blackwater state," the effects of quinine, theories of red-cell fragility and lactic-acid hæmolysis and the roles of the liver and spleen in the genesis of hæmoglobinæmia.

Blackwater fever definitely emerges as what may be termed a "paramalarial" condition—all doubt about this is now at rest.

The subject matter of the monograph is well and clearly arranged. It will be of great help to those engaged in dealing with this clinical syndrome. J. H.-S.

THE NOMENCLATURE OF DISEASES. London: His Majesty's Stationery Office. 1931. Pp. xx + 220. Price 5s. net.

The sixth edition of "The Nomenclature of Diseases," drawn up by a joint-committee appointed by the Royal College of Physicians of London, was completed in 1930, printed in 1931, but was not issued until April, 1932.

The present edition follows much the same lines as the last revision and is really a catalogue of diseases conveniently arranged for reference. The principal alterations are the addition of separate subsections on Infestation by Animal Parasites and on Deficiency Diseases. The section dealing with Diseases of the Nervous System, including the subsection on Mental Diseases, and the sections of the Appendix devoted to Vegetable and Animal Parasites, to Tumours and Poisons, have been entirely rewritten.

The section contained in the last edition which enumerated the names of recognized surgical operations has been omitted. A distinction between malignant and non-malignant growths is no longer drawn, and poisons are set out alphabetically without distinction as to whether they are drawn from animal, vegetable or mineral sources.

With regard to *synonyms* it is explained that while the name placed first is in some cases the better-known or preferable name for the disease, in other instances it is an anatomical description for which the

synonym is the convenient or precise name. In either case, both the primary name and the synonym are equally admissible in making returns. The word *synonym* has been omitted except in the Appendix for the sake of brevity, alternative names being printed immediately after or just below the primary name.

It is doubtful whether a nomenclature of diseases should include the names of symptoms of disease as well as those of recognized diseases. The committee, however, consider that the inclusion of certain symptoms which are necessary for the return of important disabilities is of obvious convenience. But they state emphatically that in no case should the names of the symptoms be used alone for certifying causes of death, these being registered in accordance with the *International List of Causes of Death.*

Space has been saved and the appearance of the book improved by printing the list of diseases in double columns. Notes and cross references have been omitted from the text. Necessary annotations are now placed at the foot of each page.

The book is up to date and should prove very useful as a work of reference.

Correspondence.

STRETCHER SLINGS AND TYPE PLAN OF A CASUALTY CLEARING STATION.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I have been particularly interested by two of the articles contained in the July number of the *Journal,* and am enclosing herewith photographs which I think may be of interest.

(1) The article by Major D. T. Richardson, M.C., R.A.M.C., on the experimental work carried out by Major A. E. Richmond, O.B.E., R.A.M.C., in 1930, emphasizes the wrong principle of the official stretcher sling.

Being attached to the Embarkation Staff at Southampton, under Sir William Donovan, from August, 1914, the difficulties under which the bearers carried on their work soon became obvious, and the constant carrying of increasing numbers of casualties made the question of man power a very important one.

In association with Lieutenant-Colonel R. W. D. Leslie, I carried out a number of experiments with stretcher slings, evolving the one shown in the photographs.

The points in its favour are obvious from the illustrations; the chest expanded upright position, the equality of the load, the use of spliced rope

for "loops," keeping them "patent" at all times, non-slipping and giving freedom of the hands (which need only be used for stopping "swing" of the stretcher).

(2) The type plan of a Casualty Clearing Station in the article by

Fig. 1.

Fig. 2.

Major T. B. Nicholls, R.A.M.C., is interesting by its absolute similarity to the one which I pitched at Mendingham in 1917. This was a development of the ideas of the late General Skinner, then D.M.S., 5th Army, as the type of a Mobile C.C.S. on a lay-out organized for speedy reception and evacuation.

R.A.M.C.T. Headquarters,
Upper Chorlton Road,
Manchester.
July 27, 1932.

I am, etc.,
T. B. Wolstenholme,
Colonel, A.D.M.S., 42*nd* (*E.L.*) *Division.*

Notices.

CONCENTRATED LIQUID LIVER EXTRACT (B. W. and Co.).

Burroughs Wellcome and Co. have issued Concentrated Liquid Liver Extract (B. W. and Co.) which may supplement, or replace the whole of, the amount of fresh liver in a daily diet. It is stated to be a palatable product, and can be taken over long periods. Concentrated Liquid Liver Extract (B. W. and Co.) is issued in bottles of 4 and 16 fluid ounces, 1 fluid ounce containing the equivalent of 8 ounces of liver.

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Illingworth & Dick ..	Surgical Pathology	,,
Matheson Commission (U.S.A.)	Epidemic Encephalitis	,,
Muir & Ritchie	Manual of Bacteriology..	,,
Kahn	Psychopathic Personalities	,,
Wakeley	Aids to Surgical Diagnosis	,,
Wheeler & Jack	Medicine	,,
Gould	Medical Dictionary	,,
Souttar	Radium and Cancer	,,
Piney & Wyard	Atlas of Blood Diseases	,,
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Ball & Evans	Diseases of the Kidney	,,
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Government of India ..	Fauna of British India. Coleoptera, Vol. III	Government of India
Goldhamer	Normale Anatome des Kopfes in Rontgenbild. 2 vols	Grant
Bew	The Modern Plumber and Sanitary Engineer. 6 vols.	,,
General Medical Council	The Medical Register for 1932	,,
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Tinkler & Master ..	Applied Chemistry. Vol. 2	,,
British Dental Association	A Report on Odontomes	,,
Cheeseman	Baillière's Synthetic Anatomy. Whole Series.	Major-Gen. West
Van de Velde	Fertility and Sterility in Marriage	Grant
,, ,, ...	Sex Hostility in Marriage	,,
Graves	Female Sex Hormonology	,,

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

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Journal

of the

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Original Communications.

FURTHER INVESTIGATIONS INTO THE CHARACTERS AND CLASSIFICATION OF THE MANNITE-FERMENTING DYSENTERY BACILLI.

By MAJOR J. S. K. BOYD,
Royal Army Medical Corps.

SYNOPSIS.

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  - (1) *B. dysenteriæ* Sonne.
  - (2) Unclassified strains (*B. dispar*, &c.)

A. Introduction.

The classification of the mannite-fermenting dysentery bacilli of the type generally known as *B. dysenteriæ* Flexner, and the pathogenicity of the various races of this group, are matters which have perplexed bacteriologists and clinicians for many years.

At home it is generally accepted that the types created by the late Sir Frederick Andrewes [1]—viz., V, W, X, Y, Z, and combinations of these—embrace the majority of, if not all, the pathogenic strains, and any organism which fails to agglutinate with the serum polyvalent for these strains is regarded with considerable suspicion. This opinion is well expressed in the following sentences taken from "A System of Bacteriology," published under the auspices of the Medical Research Council [2]: "We have already seen that this (*failure to agglutinate*) does not absolutely exclude the bacillus from the Flexner group, since the antigenic range of the type races is probably insufficient, by a small margin, to cover the whole group. But the great majority of such aberrant strains will be found, on thorough examination, to exclude themselves from the group by some divergent cultural or biochemical character."

In the Army in India a different state of affairs obtains. It has been the practice to report all strains which give the correct biochemical reactions as *B. dysenteriæ* Flexner, or *B. dysenteriæ* Flexner (inagglutinable), as the case may be. The following figures, taken from official records, indicate the extent to which these "inagglutinable" strains have been occurring.

Table I.

Year	Agglutinable	Inagglutinable	Per cent inagglutinable
1926	271	129	32·25
1927	342	164	32·4
1928	492	306	38·2
1929	922	286	23·7
1930	1077	360	25·4

It is obvious, therefore, either that strains in India are being too loosely classified as "Flexner," or that serological types are of common occurrence there which have not come under review at home.

The question is one of some importance. Until a few years ago it was commonly believed that most cases of dysentery occurring among the troops in India were amœbic and not bacillary in origin, but the pioneer work of Manifold [3] and others has shown that the reverse is actually the

case. The frequent occurrence of these inagglutinable strains, elsewhere regarded with suspicion, has been, in the controversy which arose on the subject, a constant stumbling-block in the path of those who favour the bacillary doctrine. Further, while in certain cases these atypical strains were found to occur in such a way as to suggest strongly their pathogenicity, in others they appeared in circumstances entirely the reverse. There were, therefore, *a priori* grounds for suggesting that some strains were pathogenic and others were not. With a view to solving, if possible, these problems, the present investigation was undertaken.

For a time it was thought that these inagglutinable bacilli might be Andrewes' types, which for some reason or another failed to react to the agglutination test. This conception was soon found to be wrong, and it became clear that the organisms were distinct serological types which lay outside the antigenic range of the type races. As a preliminary step, it therefore became essential to define and classify these serological types. So far as strains occurring in the south of India are concerned, this has been more or less accomplished.

B. Proposed Classification.

(*a*) *By Biochemical Reactions.*

It has been found that a useful preliminary classification can be effected by the biochemical reactions of the organisms. The "sugars" used are lactose, glucose, mannite, dulcite and saccharose. Table II shows the relationship of the dysentery bacilli to other coliform organisms, as well as the inter-relationship of the three subgroups now suggested, which are differentiated by their action on dulcite, lactose and saccharose.

A more detailed classification by means of further "sugar" media has proved unsatisfactory, and, indeed, the reactions shown in the tables are not invariably constant, as will be shown at a later stage. Serological tests are used for the further subdivision of the strains and provide the only definite method of identifying the various types.

(*b*) *By Serological Reactions.*

High-titre sera were prepared for a large number of selected strains, and tested against every strain which had been collected, and against other strains subsequently isolated. In this way various types were identified, which were further confirmed by a series of absorption and cross-agglutination tests. These types, and the subgroups in which they occur, are shown in Table IV. Some of these are already universally recognized; others have been previously described by the writer [4]; the remainder are now described for the first time. Each new type is given, as a means of identification, the laboratory index number of the type strain. The question of a less cumbrous nomenclature need not be considered until the work has received adequate confirmation. For convenience the strains described by

Andrewes, viz., V, W, X, Y, Z, and combinations of these, are called the "classical Flexners."

There is also embodied in the table a series of figures to show the relative frequency with which these types have occurred in one area in Southern India. With the exception of three which were accidentally lost, every strain of non-mannite fermenting, dysentery-like bacilli recovered

TABLE II.

NON-, OR LATE-LACTOSE, FERMENTING COLIFORM BACILLI.

Motile, or gas producing in glucose. Enterica, Salmonella, etc.

Non-motile, acid without gas in glucose.

Acid without gas in mannite.

No acid or gas in mannite. *B. dysenteriæ* Shiga *B. dysenteriæ* Schmitz, etc.

Subgroup A.	Subgroup B.	Subgroup C.
Dulcite, Lactose, Saccharose } No change.	Dulcite = Acid, no gas. Lactose, Saccharose } No change.	Dulcite = No change. Lactose, Saccharose { Acid, no gas, late, in either or both.
B. dysenteriæ Flexner, etc.	*B. alkalescens.* Type 88, etc.	*B. dysenteriæ* Sonne *B. dispar*, etc.

from cases of dysentery and diarrhœa by the writer in the Madras District Laboratory, Bangalore, in 1930, and Southern Command Laboratory, Poona, in 1930 and 1931, is included in this series, which is therefore representative and entirely unselected.

Table III shows in another way the characters of the three subgroups.

TABLE III.

	Lactose	Glucose	Mannite	Dulcite	Saccharose
Subgroup A..	—	A	A	—	—
,, B..	—	A	A	A (late)	—
,, C..	A (late) + or —	A	A	—	A (late) + or —

A = Acid.

It will be seen that the classical Flexners comprise slightly over half the series. Taking these together with *B. dysenteriæ* Sonne (the only other type which is usually identified serologically) a total of approximately sixty per cent is reached. In round figures, therefore, two-fifths of all strains in this series giving in twenty-four hours correct Flexner biochemical

reactions fall into the class generally labelled "inagglutinable Flexner." Two of the described types do not occur in this series.

TABLE IV.

	Serological type	Number of strains	Total	Percentage	Total percentage
Subgroup A	Classical Flexners	138		51·69	
	Type P 119	7		2·62	
	,, 103	24		9·00	
	,, 170	11		4·11	
	Unclassified	3		1·12	
	Total		183		68·54
Subgroup B	Type 88	21		7·87	
	,, P 288	9		3·37	
	,, P 274	3		1·12	
	,, D 1	2		0·75	
	,, D 19	—		—	
	B. alkalescens	—		—	
	Total		35		13·11
Subgroup C	*B. dysenteriæ*, Sonne ..	23		8·61	
	Unclassified	26		9·74	
	Total		49		18·35

C. Pathogenicity.

Certain tentative conclusions have been formed regarding the pathogenicity of the new types, but it is obvious that in some cases these require repeated confirmation before they can be accepted.

With dysentery bacilli it is not possible to satisfy the third of Koch's postulates, as the infection of volunteers with cultures is an impracticable proposition, and animal inoculation affords no reliable information. There are, however, data related to the first two postulates which apply to certain of the types :—

(*a*) The organisms have been recovered only from cases with symptoms of bacillary dysentery. This implies control investigations of the stools of healthy individuals, and such controls have been carried out on a large scale. During the three years that were occupied with these researches, over 3,000 menials were examined to ascertain if they were "carriers" of infectious bowel conditions. This involved, among other things, 8,000 odd platings of fæces, the majority of which were carried out under ideal conditions. The subject was given a saline purge, and the subsequent stool was passed in a latrine on the laboratory premises. A fresh specimen from this was at once secured and plated and examined in exactly the same way as a dysentery (or enteric) specimen. None of the strains which are considered pathogenic has ever been isolated from these controls, except in a few rare cases where, on investigation, the individual was found to be suffering from acute or chronic bacillary dysentery. In addition, by what is no doubt a coincidence, the only organisms isolated under these circumstances have been classical Flexners, Shiga or Schmitz.

(*b*) The organisms have been present in the stools during the same stages as the "classical" dysentery bacilli, i.e., in almost pure culture in the early acute stages and rapidly diminishing in numbers as the case progresses.

(*c*) Although the cases were clinically and microscopically bacillary dysentery, and were carefully investigated at the correct times, "classical" dysentery bacilli have not been isolated in association with the new types, despite the fact that several colonies were invariably selected and examined from each case.—(N.B. This does not apply to the types noted as probably non-pathogenic).

This point is mentioned because it is commonly stated that in the early stages of bacillary dysentery unusual types of organisms, which have their habitat high up in the bowel, are washed down and appear in association with the causative dysentery bacilli. This has been found by the writer in the case of *B. morgan* and of certain of the saccharose fermenters. It does not apply to the other strains.

(*d*) Certain strains have a well-marked antigenic similarity to the classical Flexners in that, when injected into a rabbit, they stimulate the production of a varying degree of heterologous agglutinins for the latter organisms.

(*e*) Agglutinins for the organism may develop in the patient's serum. This has been definitely found in the case of one type (88), but has not been fully investigated in the others.

D. Details of the Various Types.

(*a*) *Subgroup A.*

In the 1931-32 series, 68·5 per cent of all strains isolated belong to this subgroup.

Seventy-five per cent of the subgroup is made up of classical Flexner strains. Of the remaining twenty-five per cent all but three strains fall into the new types described.

In addition to these three unclassified strains of the 1931-32 series, eight other strains with the biochemical reactions of subgroup A (collected from a variety of sources) fail to conform to any of the types. These eleven will receive separate consideration.

The serological characters of this subgroup are complex, and will be detailed in the description of each type, as will also questions of mutation and pathogenicity. With the exception of Type 170 and the unclassified series, they are closely interrelated.

(1) Classical *B. dysenteriæ* Flexner (V, W, X, Y, Z, etc.)

There is nothing of importance to add to the knowledge which has accumulated regarding these types, and only a few general remarks need be made.

The local incidence of the types in Southern India is shown in Table V, which is an analysis of the 138 strains mentioned in Table IV. The sera used for identification were those supplied by the Enteric Laboratory, Kasauli, in the manufacture of which every care is exercised to use only smooth strains of organisms.

TABLE V.

	V	W	X	Y	Z	VZ	Others
Number	8	43	4	11	12	19	41
Percentage of 1930-31 series ..	3	16·1	1·5	4·12	4·5	7·1	15·35
Percentage of each type in the classical Flexner series	5·8	31·16	2·9	7·97	8·7	13·76	29·71

The only strains calling for special comment are those labelled "others." The majority were combinations such as V, W, Z; X, Y, Z, etc. A proportion, however, did not agglutinate to full titre with any of the five sera, and it is possible that such strains may possess a distinctive antigen of their own in addition to the group antigen. The next type to be described, P 119, is an example of this, differing only in that its agglutination with sera of the classical strains falls far short of titre. The precise identification of strains which agglutinate approximately to titre with several sera is of little practical importance for diagnostic purposes. They are sufficiently related to the classical types to enable them to be classified along with the former without difficulty.

Mutation.—Strains of the classical Flexners were not, with a few exceptions, preserved for prolonged periods, and no evidence of true mutation from S to R was ever observed.

Pathogenicity.—The pathogenicity of the classical types has long been accepted. All the strains in this series were isolated from cases of dysentery, either acute, moderate, or in some cases so mild as to be labelled merely diarrhœa.

So far as the writer's experience goes, there is no such thing as a *healthy* carrier of dysentery bacilli. In the few rare cases where a bacillus has been isolated from an apparently normal individual, a careful search of a large specimen of fæces, well washed in saline, invariably revealed the presence of traces of cellular mucus. Further, one would expect a true "normal" carrier to excrete the organisms on repeated occasions, as does a carrier of, say, *B. typhosus.* This, so far as one is aware, has never been found, other than of course in a chronic or subacute case.

Serological Diagnosis of Dysentery Caused by Organisms of this Type.—During 1930 a number of agglutination tests were carried out with the sera of patients infected with these types. No new facts emerged, and

the findings of others were confirmed, viz., that the development of agglutinins is very uncertain, that it occurs so late as to be of little or no value for diagnostic purposes so far as acute cases are concerned, and that the agglutinins which develop frequently do not correspond to the antigenic type of the infecting organism. The test has been abandoned as a routine, being of no practical value.

(2) *Type P* 119.

This type is closely allied to the classical Flexners, and particularly to X.

In all 12 strains have been isolated and investigated, 8 from Poona, 2 from Jubbulpore and 2 from Bangalore.[1]

In its biochemical reactions it corresponds exactly with the classical Flexners.

Table VI shows the agglutination reactions on isolation.

TABLE VI.

		Serum					
		V	W	X	Y	Z	P 119
Organism ..	P 119	10	—	10	10	—	100
	P 190	5	—	4	10	—	100
	P 272	—	—	10	10	—	100
	P 283	—	5	5	15	—	100
	P 326	5	—	10	10	—	100
	P 329	—	—	10	5	—	100
	P 493	—	—	10	10	25	100
	Dec. 6	4	—	10	10	5	100
	Dec. 7	5	—	25	10	5	100
	Md. 5	7	—	25	10	8	100
	Md. 7	5	—	25	10	5	100
	P 584	5	10	15	10	15	100

[*Note.*—In this and in all subsequent tables the figures shown are in percentages of the titre of the serum in question for its homologous organism; e.g., V serum has a titre of $\frac{1}{500}$ for its homologous organism, V; this serum agglutinates P 119 in a dilution of $\frac{1}{50}$; P 119 is therefore agglutinated up to 10 per cent of titre, and the figure 10 is shown in the table.

It must be clearly understood that such figures are only approximate. The apparent agglutinability of an organism varies from time to time under the influence of a variety of factors. As far as possible a uniform technique has been employed, but experience demonstrates that standard results have not been attained. The variations are, however, insufficient to upset the conclusions formed.]

Table VII shows the serological interrelationship of this type with the rest of the series :—

[1] A further strain has just been received from Mingaladon in Burma.

TABLE VII.

	V	W	X	Y	Z	P 119	103	170	88	P 288	P 274	D 1	D 19	*B. dys.* Sonne
P 119 agglutinated by various sera	10	—	10	10	—	100	5	—	—	—	—	—	—	—
P 119 serum with various organisms	12·5	2·5	17·5	25	20	100	5	—	—	—	—	—	—	—

Tables VIII and IX show absorption tests with serum prepared from Strain P 119, and from Strain P 493, another similar organism:—

[*Note*.—In these and in all other absorption tests in this investigation the method of complete saturation with the absorbing organism was employed. The dose of organisms added to the serum was sufficient to ensure that after two hours at 37° C. and overnight at room temperature, the supernatant fluid still remained turbid, so that prolonged centrifuging was necessary to throw down the suspended (i.e., non-agglutinated) organism.]

TABLE VIII.

	V	W	X	Y	Z	103	P 119
P 119 serum control	12·5	2·5	17·5	25	20	2·5	100
P 119 serum absorbed "V" ..	—	1·5	5	12·5	10	—	100
,, ,, "X" ..	—	—	—	12·5	—	—	12·5
,, ,, "Y" ..	—	—	5	—	5	—	50
,, ,, "Z" ..	—	—	5	5	—	—	25
,, ,, P 119 ..	—	—	5	2·5	5	—	—

TABLE IX.

	V	W	X	Y	Z	103	P 119	P 493
P 493 serum control	10	2	40	25	20	2	100	100
P 493 absorbed P 493	1	—	1	2	—	—	2	5
,, P 119	1	—	5	—	5	—	2	10
,, X	—	—	2	2	—	—	10	40
,, 103	2	1	10 +	10 +	10 +	—	50	100

The capacity of X to absorb agglutinins from both the sera tested will be noted, as well as the high content of heterologous agglutinin for X in P 493 serum. X serum was accordingly absorbed, with the results shown in Table X:—

TABLE X.

	V	W	X	Y	Z	P 119	P 493
X serum control	50	—	100	50	50	10	40
,, absorbed P 119 ..	25	—	50	10	25	—	—
,, ,, P 493 ..	—	—	40	29	—	—	—

From these results it will be seen that although P 119 has much in common with X, it has nevertheless an antigenic structure peculiar to itself, and must therefore be regarded as a separate type.

Mutation.—In view of the results obtained with Type 103 (about to be described), numerous attempts have been made to cause P 119 to produce an agglutinable variant, but without success. Marked variations in colony characters were obtained, but these did not betoken any alteration in antigenic pattern.

Pathogenicity.—Of the eight cases isolated in Poona, all were from typical cases of dysentery, six showing bacillary exudate, and two indefinite exudate. In no case did a mixed infection with any other dysentery organism occur, nor was the organism isolated except during the acute phase of the disease. It was never found in the 8,000 odd platings made from non-dysenteric individuals.

No agglutination tests have been carried out with the serum of a patient harbouring this organism.

In every way except its exact antigenic complex, P 119 is identical with the classical Flexners, and there seems no reason why it should not be regarded as a hitherto undescribed member of the group. It is of relatively common occurrence, as in 1931, 7 strains of this organism were isolated in Poona, as compared with 4 of V, 3 of X, and 2 of Y.

(3) *Type* 103.

Forty-one strains of this organism have now been isolated or identified by the writer. These have the following distribution :—

Secunderabad, 1928-29	3
Bangalore, 1929-30-31	12
Poona, 1930-31	19
Jubbulpore, 1931	1
Mhow ,, ...	1
Quetta ,, ...	1
Meerut ,, ...	4

Description of Organism.—As the type has already been fully described [4], only a brief résumé and a few additional facts need be given.

Its biochemical reactions are identical with those of the classical Flexners.

Its serological characters are shown in Table XI.

TABLE XI.

	V	W	X	Y	Z	P 119	103	170	88	P 288	P 274	D 1	D 19	*B. alkalescens*	*B. dys.* Sonne
103 agglutinated by sera indicated	—	—	5	—	—	5	100	—	—	—	—	—	—	—	—
103 serum with the organism indicated	25	15	40	40	6	5	100	—	—	—	—	—	—	—	—

Mutation.—This organism is unique in that, after a variable period of culture on artificial media, it produces an agglutinable variant very similar to Y, which in course of time completely overgrows and replaces the original type.

Fifteen strains have been isolated in the Southern Command Laboratory since the date of the last publication, and intermittent attempts have been made to stimulate these to form agglutinable variants. Two have done so, but the remainder still show the 103 antigenic pattern.

Strain P 61, belonging to the series previously reported, has produced an agglutinable variant under circumstances worthy of record. This strain was selected because of the fact that it showed no tendency to produce agglutinable variants, and was sent to the Enteric Laboratory, Kasauli, to be used there for the production of Type 103 serum. On October 10, 1931, in the Southern Command Laboratory, a plate which was made from a twenty-four-hour broth culture of this strain was found to contain both the original colony and the agglutinable variant. On October 15, 1931, information was received from Kasauli that their strain had become agglutinable, although no variation in colony type could be detected. A further subculture from Poona was sent to Kasauli, and the occurrence of both types of colonies in this subculture was there confirmed. The coincidence in time of the development of the agglutinable phase is striking.

Mention must be made of the fact that colonies having the physical but not the antigenic characters of the agglutinable variant have been encountered from time to time in plates from these strains. Such rough colonies agglutinated in a manner similar to newly isolated 103. Their significance is not known. They showed only a trace of agglutination with Flexner R serum.

It would, therefore, appear that 103 is liable to a variety of colony mutations.

Attention has also been drawn to variations in agglutinability which this organism shows. Certain strains fail to agglutinate beyond fifty per cent of the titre of the serum. Whether this represents a type within a type is a matter for further investigation.

(*To be continued.*)

RESULTS OF TREATMENT OF MALARIA BY (*a*) PLASMOQUINE AND QUININE, AND (*b*) ATEBRIN, TOGETHER WITH SOME OBSERVATIONS ON MALARIA CONVALESCENTS.

By Major O. D. JARVIS, O.B.E.,
Royal Army Medical Corps.

(*Continued from p.* 199.)

Case 5. Malignant tertian malaria.—Pte. C. arrived at the Centre on February 29, 1932, with a recorded history of three attacks of malignant tertian malaria between October and December, 1931, and one attack of benign tertian in January, 1932. The patient stated that he had had seven attacks since September, 1931.

On March 8, 1932, one week after arrival, he reported sick complaining of headache, vomiting and epigastric pain. He had no fever and blood-smears were negative for malaria. The following day he felt better. On the third day malignant tertian rings were seen. When rings had been continuously present for three days, with no symptoms beyond the initial ones described, Treatment "K" was started. Rings disappeared within forty-eight hours of commencement of treatment. Crescents appeared for the first time on the sixth day of treatment and disappeared eight days later.

The red count and hæmoglobin were 3·6 million and 56·2 per cent. at the beginning, and 3·6 million and 70·1 per cent at the end, of the seven days' course. (The rapid rise in the hæmoglobin percentage is much greater than one would expect from the effect of altitude alone.)

This case has been observed for only two weeks without relapse, since completion of treatment. Atebrin was excreted in the urine from the second day of treatment and is still being excreted at the time of writing (twenty days).

Table V recapitulates the chief features of the five cases.

In attempting to assess the value of atebrin in the treatment of malaria, it may be said that, although the number of cases is much too small to make reliable deductions, the results are such as to warrant more extensive trial of the drug. So far as control of the fever and other symptoms and the clearance of parasites from the peripheral blood in benign tertian malaria are concerned, atebrin would appear to be as effective as plasmoquine and quinine. It appears also to be equally effective against the rings in malignant tertian malaria, although the crescents persist for a long time. The effect on fever and other symptoms in malignant tertian malaria was not observed, as the three cases treated had none.

The drug is easy to administer and to take (in the form of tablets orally), and has produced no toxic or other symptoms, and no discoloration, when

given in a dose of 0·1 gramme thrice daily for seven consecutive days. It is excreted for a considerable period (in the present series for an average of at least twenty-six days), so that it probably exerts its therapeutic action for about three times the period for which it is actually administered. We have thought that the appearance of the patients improved more rapidly

TABLE V.

RESULTS OF TREATMENT OF FIVE CASES OF MALARIA WITH "ATEBRIN" 0·1 GRAMME THRICE DAILY FOR SEVEN DAYS.

	Case 1	Case 2	Case 3	Case 4	Case 5	Average
(1) Type	B.T.	B.T.	M.T.	M.T.	M.T.	—
(2) Number of previous attacks ..	2	3	7	2	3	—
(3) Day of disease on which parasites appeared: (a) Asexual ..	1	1	1	1	3	—
(b) Sexual ..	—	4	1	4	10	—
(4) Febrile attacks immediately prior to treatment	1	1	—	—	—	—
(5) Day of disease on which treatment began	4*	2*	4*	4*	4*	—
(6) Febrile attacks after start of treatment	1	1	—	—	—	—
Duration of fever in days ..	½	½	—	—	—	—
(7) Hours within which parasites disappeared after start of treatment: (a) Asexual	48	84	36	84	48	60
(b) Sexual	—	120	50 days	72	8 days	17 days†
(8) Day of treatment excretion started	Test inconclusive	2	4	4	2	3†
(9) Number of days excretion lasted..	,,	37	16	30	20	26†
(10) Red count in millions at:						
(a) Start of treatment ..	5·0	4·8	4·8	4·6	3·6	4·5
(b) End of treatment ..	—	4·8	4·6	4·8	3·6	4·5
(c) 5 weeks after (b) ..	—	—	—	5·2	—	—
6 ,, ,, ,, ..	5·4	—	5·2	—	—	—
9 ,, ,, ,, ..	5·6	5·1	—	—	—	—
10 ,, ,, ,, ..	—	—	5 4	—	—	—
13 ,, ,, ,, ..	5·8	—	—	—	—	—
(11) Hæmoglobin percentage at:						
(a) Start of treatment ..	84·0	81·3	81·3	73·7	56·2	73·1
(b) End of treatment ..	—	92·3	85·6	81·3	70·1	82·3†
(c) 5 weeks after (b) ..	—	—	—	89·5	—	—
6 ,, ,, ,, ..	89·5	—	89·5	—	—	—
9 ,, ,, ,, ..	90·9	89·5	—	—	—	—
10 ,, ,, ,, ..	—	—	90·9	—	—	—
13 ,, ,, ,, ..	97·9	—	—	—	—	—
(12) Weeks without relapse after end of treatment	13	10	10	6	2	8

* From first appearance of parasites. † Average of cases 2 to 5 only.

under its influence than with other treatments, and this is to some extent confirmed by the rapid rise in the hæmoglobin percentage, which in most of the cases was greater than might have been expected as the result of altitude alone.

We are informed that the patients, discussing the treatment amongst themselves, are satisfied that atebrin is the best form of antimalaria treatment they have so far experienced.

It is proposed to give the drug to further cases as the opportunity

offers; if future experience confirms the results obtained in the five cases here recorded, it is thought that atebrin will mark a definite advance in malaria therapy.

VIII.—Anæmia in Malaria Convalescents.

In previous years it has been the custom to accept the hæmoglobin percentage as the index of the degree of anæmia in malaria convalescents attending the Centre, and to gauge the improvement in the blood condition by the rise in this percentage, which usually occurred. In view, however, of the fact that in practically all cases there is a considerable physiological rise in both the hæmoglobin percentage and the red count due to altitude alone, and Kasauli stands at approximately 6,000 feet above sea-level, it was felt that, without a previously ascertained standard, it was impossible to determine how much of the increase was purely "physiological," and how much due to actual improvement in the patient's condition. Throughout 1931, therefore, red cell-counts were made regularly, in addition to the estimation of the hæmoglobin percentage, on all convalescents; and, to serve as a standard, nineteen students of the Army School of Physical Training were tested weekly, twelve for ten weeks, and seven for five weeks.

The A.S.P.T. holds two courses in Kasauli for British officers and "other ranks," between the middle of April and the beginning of July; one a long course of twelve weeks' duration, the other a short one of six weeks. Both courses are admittedly strenuous, and the question was raised as to whether it was sound to hold such courses at a height of 6,000 feet.

It has been more or less generally accepted that when a person goes from the plains to the hills, he should not indulge in too strenuous exercise until he has become "acclimatized" to the height, and that the period necessary for this "acclimatization" may be put at ten to fourteen days.

In order to see if any guidance might be obtained as to the necessity of modifying the courses, and also to serve as a standard by which to judge the degree of anæmia of malaria convalescents, it was arranged, by the courtesy and with the co-operation of Major B. H. G. Tucker, M.B.E., Commandant, A.S.P.T., to examine a representative sample of the students attending the P.T. courses.

Five million is usually accepted as the average number of red cells per cubic millimetre of blood in a European, presumably at, or near, sea-level, although this is often considered too low an estimate. What, then, is the average for the fit British soldier in India, and what increase should be expected week by week during his residence at 6,000 feet?

A.S.P.T. Students.

(*a*) Red blood-corpuscles: Fig. 1 (unbroken line) shows the average number of red cells week by week. It is admitted that the number of men examined is small, but the results, such as they are, are interesting.

It will be seen that the average red-count of the students on arrival in Kasauli was 4·7 million. (The lowest figure was 4·0, the highest 5·6 million.) There was a more or less steady rise weekly up to the seventh week, when the average figure stood at 5·7 million, i.e., a twenty-one per cent increase. For the three following weeks up to the tenth there was no further rise, but rather a tendency to drop. The rise was steepest in the first two weeks, the increase being one of 8·5 per cent. In the second period of two weeks the further rise was only 3·9 per cent, and in each of the three succeeding fortnightly periods 1·9 per cent, 1·9 per cent, and 1·8 per cent respectively.

R.B.C.(in millions) —— Hb.%. - - - -

Week	0	1	2	3	4	5	6	7	8	9	10
R.B.C.	4.7	4.9	5.1	5.2	5.3	5.4	5.4	5.7	5.5	5.7	5.6
Hb.%.	87.9	91.4	93.0	92.9	92.9	93.6	91.6	92.6	90.8	90.7	91.9

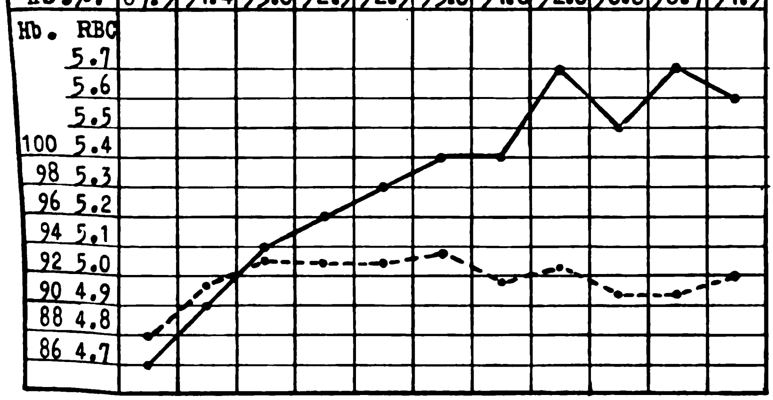

FIG. 1.—A.S.P.T. students. Weekly average red-count and hæmoglobin percentage.

If one were justified in formulating a rule from such small numbers, it would be: Add 0·2 million a week for the first two weeks, then 0·1 million a week up to the end of the sixth week, when the red cells seem to reach their maximum (temporarily, at least).

(*b*) Hæmoglobin percentage: Fig. 1 (broken line) shows the average hæmoglobin percentage week by week. The students on arrival in Kasauli had on the average 87·9 per cent hæmoglobin. By the end of the second week it had risen to ninety-three per cent. Thereafter, there was only one week (the fifth) when it rose a little higher than that (93·6 per cent). Otherwise, the tendency was for the figure to remain fairly constant or to drop a little. Thus, in the first two weeks there was an increase of 5·1 per cent, and in the first five weeks an increase of 5·7 per cent. In the second period of five weeks there was a decrease of 1·7 per cent, compared with the figure reached at the end of the fifth week. The actual increase in ten weeks was 4·0 per cent.

(*c*) Colour-Index: Without an accepted standard for the average increase of red cells with increase of altitude, it is impossible to calculate the colour-index. If it is known that in the normal person the number of erythrocytes increases appreciably week by week, it is obviously absurd to use a fixed number of red cells (whether five or six million) in the calculation. Reference to fig. 1 shows that, after the first fortnight, the rate of increase in the red count is relatively much greater than is that of the hæmoglobin percentage.

Fig. 2 compares the colour-index calculated on a fixed average red-count of five million with the index obtained by the use of a varying count, viz., the actual weekly average obtained in the present inquiry. In the former

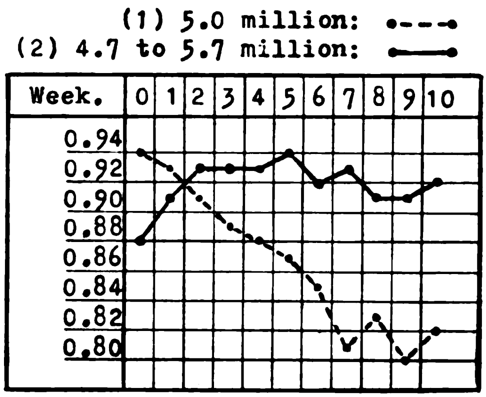

FIG. 2.—A.S.P.T. students. Weekly average colour-index calculated on a red count.

case the index shows a more or less steady fall from 0·94 in zero week to 0·80 in the ninth week, with a general average of 0·87; while in the latter case it rises from 0·88 to 0·93 in the first two weeks, and thereafter remains fairly constant between 0·91 and 0·94, with a general average of 0 92.

Malaria Convalescents.

It is interesting to compare the above results with the corresponding figures for malaria convalescents, with regard to whom the results in fifty-two cases are averaged.

(*a*) Red blood-corpuscles: Fig. 3 compares the average weekly red-counts of A.S.P.T. students and malaria convalescents. In the latter, the lowest figure on arrival was 3·2 million, and the highest 5·6 million.

The chief points of interest appear to be: (1) With very few exceptions malaria convalescents are not anæmic as compared with fit men; (2) on the contrary, their average red-count on arrival and at the end of the first week is distinctly higher than that of the A.S.P.T. students. After the first week the figures correspond very closely indeed; (3) the most rapid rise in the number of red cells is in the first week.

A striking feature is the infrequency of palpably enlarged spleens, whether in convalescents or in patients with a frank attack of malaria. This is probably related to the blood-findings, and both may be explained

A.S.P.T. Students: •——• Convalescents at M.T.C.: •---•

Week.		0	1	2	3	4	5	6	7	8	9	10	11	12
RBC	ASPT	4.7	4.9	5.1	5.2	5.3	5.4	5.4	5.7	5.5	5.7	5.6		
	MTC	4.9	5.3	5.2	5.2	5.3	5.3	5.4	5.5	5.5	5.5	5.6	5.6	5.6

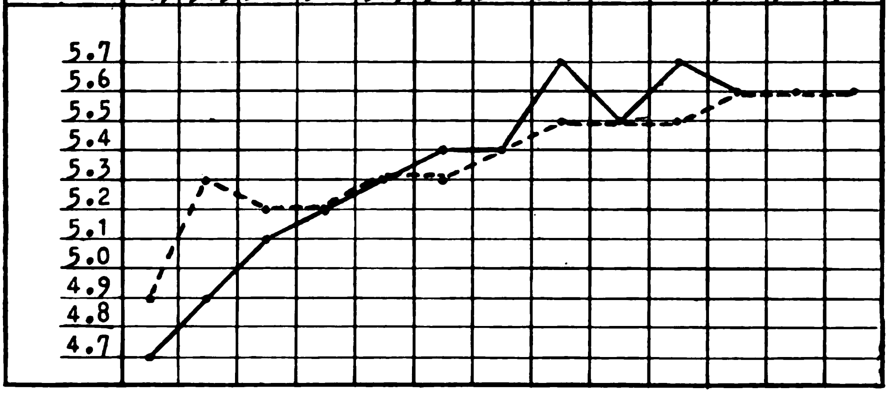

FIG. 3.—Weekly average red blood-count (in millions).

A.S.P.T. Students: •——• Convalescents at M.T.C.: •----•

Week.		0	1	2	3	4	5	6	7	8	9	10	11	12
Hb%	ASPT	87.9	91.4	93.0	92.9	92.9	93.6	91.6	92.6	90.8	90.7	91.9		
	MTC	83.7	86.5	88.2	89.1	90.1	89.8	91.7	91.5	92.5	93.3	92.6	94.1	93.4

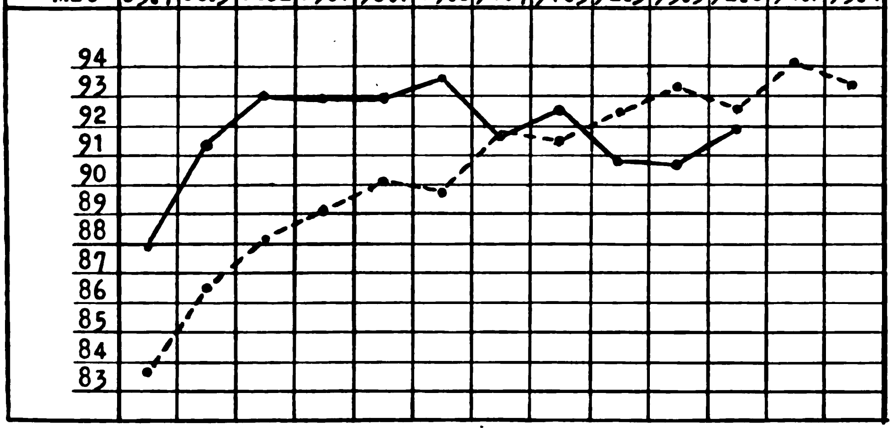

FIG. 4.—Weekly average hæmoglobin percentages.

by the fact that the British soldier as soon as he develops an attack of malaria comes at once under treatment, which usually effectively controls the fever, if it does not prevent a subsequent relapse; with the result that,

although he may have five or six relapses in the course of a year, he may have just as many (or as few) days' fever, and consequently does not become very debilitated and anæmic from repeated attacks. One has the impression that the case may be very different with Indians and possibly also with British officers and women and children, who often carry on in spite of malaria and with inadequate treatment, often self-prescribed.

(*b*) Hæmoglobin percentage : Fig. 4 compares the average hæmoglobin percentages of A.S.P.T. students and malaria convalescents week by week. Although malaria convalescents show a higher average red-count than A.S.P.T. students on arrival and for the first week after, their hæmoglobin percentage is distinctly lower for the first five weeks. This presumably

A.S.P.T. Students: •——• Convalescents at M.T.C.: •---•

Week.		0	1	2	3	4	5	6	7	8	9	10	11	12
RBC taken as normal		4.7	4.9	5.1	5.2	5.3	5.4	5.5	5.6	5.6	5.6	5.6	5.6	5.6
C.I.	ASPT	.88	.91	.93	.93	.93	.94	.93	.91	.93	.89	.92		
	MTC	.80	.80	.86	.89	.90	.92	.94	.93	.94	.95	.93	.94	.93

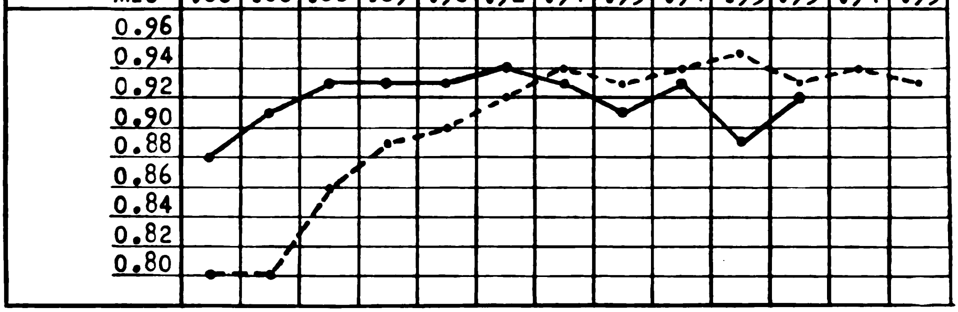

FIG. 5.—Weekly average colour-index.

indicates that, compared with fit men, their red cells are fewer to start with. It would be interesting to confirm this by micrometry.

Since the red counts of convalescents correspond so closely with those of fit men (except in the first week), and it is hæmoglobin in which the former are deficient, it would appear that the previous custom of taking only the hæmoglobin percentage as a weekly routine gives all the information necessary (provided due allowance is made for the effects of altitude).

(*c*) Colour-index : Fig. 5 is inserted to show how the colour-index of malaria convalescents compares with that of A.S.P.T. students. In the calculation a varying red-count (as shown at the head of the figure) has been used.

It will seen that the colour-index of convalescents is low, compared with that of fit men, for the first month, and that it rises steadily from 0·80 at the end of the first week to 0·94 at the end of the sixth week, after which

it remains fairly constantly in the region of 0·94, a little higher than that of fit men.

Before leaving the subject of blood-counts it may be remarked that in 1912 Acton and Harvey [3] made red-counts on Indian patients (all adult men) at the Pasteur Institute at Kasauli. They found that in seventy-five cases the average number of erythrocytes per cubic millimetre was 5·6 million on arrival of the patients from the plains and that on the eighteenth day of residence in Kasauli the mean had risen to 6·5 million. These results are interesting for comparison with ours, as they were obtained in the same station. They are placed side by side in Table VI for easy reference :—

TABLE VI.—RED BLOOD-CELL COUNT IN MILLIONS.

Day :	1st	18th	21st
Pasteur Institute, Kasauli	5·6	6·5	—
A.S.P.T., Kasauli ..	4·7	—	5·2
Malaria Convalescents ..	4·9	—	5·2

It is admitted that the number of cases is comparatively small, but, even so, the difference is striking. On general impressions alone one would not have guessed that the average Indian male would have a higher red-count than the average young British soldier.

IX.—WEIGHT OF MALARIA CONVALESCENTS.

ERRATUM

Major O. D. Jarvis' article, "The Results of Treatment of Malaria," &c., in the October number of the Journal: On page 258, line 12, the word "fewer" should read "smaller."

tive purposes it may be stated that of the nineteen A.S.P.T. students examined the average weight on arrival was 144·4 pounds, and at the end of the twelve weeks' course was 142·6 pounds, a decrease of 1·8 pounds. The average decrease in weight of all A.S.P.T. students during the long (twelve weeks') course was 2·8 pounds, and during the short (six weeks') course 1·6 pounds.

It is interesting to note that the malaria convalescent, in spite of repeated attacks of malaria, is well up to average weight before receiving any treatment at the Centre, and that, as a general rule, he puts on a few pounds during his stay in Kasauli, whereas the general tendency of the fit man doing strenuous exercise is to lose a little. It must be understood, however, that, although the malaria convalescent does a certain amount of physical training and performs certain routine duties, the amount of exercise he takes is small compared to that to which A.S.P.T. students are subjected.

X.—Quinine Excretion.

In the annual report of this Centre for 1930, Major A. E. Richmond, O.B.E., R.A.M.C., recorded work done on "quinine absorption," taking the amount of quinine excreted in the urine as an index of the amount absorbed. Tanret's reagent was used, and the opacity obtained, when quinine was present, estimated against Brown's opacity tube colorimeter. Specimens of urine passed at intervals of approximately two hours after the ingestion of quinine were examined, and the main findings were:—

(1) The largest quinine excretion figure was given at four hours, the next largest at five and a half hours, the figures at two hours and seven and a half hours being small in comparison, both in men with no malaria history and in men with a history of chronic malaria.

(2) No definite connection was shown between low excretion figures and lack of therapeutic efficacy of quinine, except possibly in one case, which was the worst and most persistent case of malaria treated that year.

During 1931 the total twenty-four hours' urine of all patients undergoing the combined plasmoquine and quinine treatment was tested daily by the opacity method already described, and it was found that some men were good excretors, giving a comparatively high excretion figure every day for the fourteen or twenty-one days of the course; others were bad excretors, excreting none, or very little consistently day by day; while yet others were intermittent excretors, giving fairly good excretion figures for a few days, then failing to excrete entirely for the next few days, and so on. As none of our fifty-three cases treated with plasmoquine and quinine relapsed, no connection could be shown between poor quinine excretion and lack of therapeutic efficacy of quinine. Furthermore, the febrile and other symptoms of the malarial attack were controlled by treatment just as well in the bad excretors as in the good. And we are of the opinion that the amount of excretion is not a reliable index of the amount of absorption, and that the commonly accepted deduction that, if there is no excretion of quinine in the urine, either the quinine is not being taken or is not being absorbed, and is, therefore, therapeutically inactive, is fallacious.

XI.—Albuminuria.

Major A. E. Richmond, at this Centre in 1930, noticed that the boiling of the urine in Tanret's test (for quinine excretion) revealed a good deal of unsuspected albuminuria amongst chronic malaria cases in hospital, albumin being actually present on one or more occasions in 30·6 per cent. of cases. And from experiments which he conducted he drew the conclusion that it was due more probably to quinine than to plasmoquine or malaria.

Major J. A. Manifold, D.S.O., R.A.M.C. (1931) [4], in an admirable review in the Journal of the results of treatment of malaria with plasmoquine and quinine on a large scale in the military hospitals in India, discussed, *inter alia*, the question of albuminuria. In referring to Richmond's findings, he indicated that further work was being carried

out on this subject at this Centre, but gave it as his opinion that "the presence of a certain quantity of albumin in the urine in malaria cases treated with plasmoquine and quinine is not normally an indication to withhold treatment."

During 1931 the twenty-four hours' urine of all cases treated with plasmoquine and quinine was tested for albumin daily for the fourteen or twenty-one days of the course, and in only two of the fifty-three cases did we discover a trace of albumin.

It is possible that if albumin were being passed in very small amount for a short time only, it might be detected in hourly specimens of urine (as in 1930) and missed in high dilution in twenty-four hours' specimens (as in 1931). But, to be so missed, the amount must be very small, and our experience leads us to believe that treatment with plasmoquine and quinine in the doses used in 1931 (a maximum of 0·03 gramme plasmoquine plus quinine grains 20 daily for twenty-one days) is associated with albuminuria only very rarely, and then only to an insignificant degree.

XII.—Summary.

(1) The results of work carried out at the Malaria Treatment Centre, Kasauli, India, are described.

(2) Seventy-five cases of benign tertian malaria (relapse) were treated during 1930 with 0·03 gramme plasmoquine plus quinine grains 20 daily for twenty-one days. The relapse rate was 8·0 per cent during an average observation period of 10·7 weeks after completion of treatment.

(3) Thirty-one cases of benign tertian malaria (relapse) were treated during 1931 with the same course of treatment. No further relapses occurred in this series during an average observation period of 12·7 weeks after completion of treatment.

(4) Thus, 106 cases of benign tertian malaria (relapse) have been treated with 0·03 gramme plasmoquine plus quinine grains 20 daily for twenty-one days, with a total relapse rate of 5·7 per cent.

(5) Ten cases of benign tertian malaria (relapse) were given 0·02 gramme plasmoquine plus quinine grains 20 daily for twenty-one days and ten were given 0·03 gramme plasmoquine plus quinine grains 20 daily for fourteen days. None in either series had a further relapse during an average observation period of twelve weeks after completion of treatment.

(6) Thus, during 1931 we have treated fifty-one cases of benign tertian malaria (relapse) with doses of plasmoquine and quinine presumably approaching minimal ones, with practically no toxic symptoms, and no further relapses during an average observation period of twelve weeks after completion of treatment.

(7) Five cases of malaria, two benign tertian (relapse) and three malignant tertian (relapse), treated with a new drug, called atebrin, are

described. All were given 0·3 gramme atebrin daily for seven days. Aseuxal forms of the parasites disappeared from the peripheral circulation in an average of sixty hours after commencement of treatment (malignant tertian sexual forms persisted for an average of seventeen days), no toxic symptoms developed, clinical cure occurred, and none of the cases relapsed during observation periods (up to date) of thirteen, ten, ten, six, and two weeks respectively. Atebrin continued to be excreted in the urine for an average of twenty-six days

It is thought that the drug merits more extensive trial.

(8) Comparison is made between the red blood-counts and hæmoglobin percentages of fit men and malaria convalescents, and it is shown that malaria convalescents are not anæmic as compared with fit men, although they are deficient in hæmoglobin for the first five weeks after arriving at Kasauli.

(9) Work on quinine excretion is recorded, and it is deduced that the amount of excretion is not a reliable index of the amount ingested.

(10) Albuminuria is rarely met with, and is insignificant in degree in cases of malaria treated with plasmoquine and quinine in the minimal (?) doses used.

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FURTHER CONSIDERATIONS ON THE NATURE OF VIRUS AGENTS, WITH REFERENCE TO SOME RECENT WORK.

By H. M. WOODCOCK, D.Sc.Lond.

Introductory.

Of late, attention has again been focused upon the subject of the actual nature of the infecting agent in the virus diseases. This is apparent from the account of work done given in the latest annual report of the Medical Research Council, and also from a paper by Eagles and Ledingham [5] in the *Lancet* and the editorial comment upon this, and from a report of a discussion at the Royal Microscopical Society in recent numbers of the *Lancet*. As my view is that the causal agents of these diseases are not living organisms, but substances of the nature of enzymes or ferments, which view I originally put forward and elaborated so long ago as 1921 and 1922 [17, 18], I think it is worth while to consider the significance of recent work in this connection.

In the first place it may be readily granted that valuable work has been done upon technical methods; for example, by Barnard, on the technique of "ultra-microscopy" by dark-ground illumination with ultra-violet light, by Elford on methods of ultra-filtration, and by Ledingham on centrifugalization. All of these, in their respective ways, help in enabling the finest particles of the infective material of different viruses to be detected, and their size defined within limits. So that, as the *Lancet* indicates ([5], p. 843), it is becoming in a sense—a limited sense—no longer strictly accurate to designate such viruses as invisible or filterable.

Most of such workers seem now more than ever inclined to take the view that these granules are actually micro-organisms—micro-micro-organisms, they are termed—mainly, it would appear, because they are something which can be seen. Nevertheless, it is still as necessary as ever, in my opinion, to ask whether these minute granules are, indeed, independent, living units, constituting the true virus, or only the smallest ultimate (protein) particles in digested or lysed material, which, themselves inert, nevertheless cause the infection because they have adsorbed on to them the *still* invisible and undetected ferment which constitutes the actual agent.

To this view of mine two objections have been recently raised. It has been said that while such a view is possible, (*a*) it has, in the present state of knowledge, little cogency; and (*b*) that a similar view might be logically applied to any accepted causal bacterium on the ground that it is merely the vehicle of some lesser hypothetical agent. This latter, *a priori* argument, does not, it seems to me, conform to one of the essential postulates of the old logicians, namely, is it reasonable, is it likely? By a "lesser hypothetical agent" is meant, one must infer, something which is not a constituent part of the "causal bacterium," but rather something which

has a separate existence and is not produced by the organism itself, although associated with it. I say, one must infer this, because otherwise, if by "lesser hypothetical agent" is meant the enzyme or toxin of a living bacterium, then the objection is at once non-valid; the comparison is fallacious. Because my whole point is that these granules are not living units, and hence cannot themselves produce *more* enzyme.

Now, a bacterium, it must be remembered, *is* an organism—indubitably and unmistakably so—and possesses the characteristic attributes of living matter, e.g., growth, the power of multiplication, the capacity for self-nutrition (*the* primary attribute), with all the cell-metabolism therewith involved. I have placed this quality last instead of first, to emphasize its importance for this argument. Because it is known that an organism possesses various ferments and can produce various toxic substances as a result of this enzyme-activity and cell-metabolism. *Both* these classes of substances may themselves play no small part in causing the symptoms associated with such bacterial diseases; in other words, they often supply the *toxic* element of the pathogenicity. Moreover, in many cases, such toxins can be isolated and separated from the bacteria and be proved to cause particular symptoms. But they cannot then produce more of themselves; *they can be elaborated only by the living organism!* With all these accepted facts as regards bacteria, what need then is there to hypothecate a micro-micro-organism *inside* a particular organism when there is not the slightest evidence of the presence of any such? It seems to me not only unnecessary, but illogical. And this conclusion is further reinforced when it is also remembered that in the particularly interesting condition in which some internal agent *is* known to operate pathologically upon the bacteria themselves—the case of the bacteriophages—the great majority of bacteriologists themselves decline to accept this agent as a living organism, but regard it as some form of enzyme-activity inducing autolysis!

Biological Points.

On the other hand, what a different state of affairs is met with in the subject under review. It may be well, first, to summarize the present position, *on the biological side*, of these viruses and virus agents, because that is, after all, the essential question. Only two years ago, in the annual Report of the Medical Research Council, it was said (quoting from the *Lancet* [7]): "Whether these 'viruses' are organized as minute, ultra-microscopic bodies is still an open question; in any case they are presumably too small to have an organization similar to that of such cells as have been hitherto regarded as primary units of living matter. Nobody has yet succeeded in preparing an artificial fluid which will, by itself, provide conditions in which these viruses will reproduce themselves and multiply[1];

[1] In a few cases claims have been made for such successful cultivation, but it has usually been realized subsequently that what had occurred was merely a persistence and carrying over of some of the original infective material for a few subcultures.

some of them, however, will grow in artificial conditions if a piece of surviving tissue, taken from a freshly killed animal, is added to a suitable medium. It seems to be characteristic of a virus that it can multiply only in the presence of living cells which it can infect." (N.B.—In this paragraph it would be more accurate to say "increase" for "multiply," since the latter term, as used in a biological sense, at once connotes a function of a living organism.)

To these points must be added others, such as the greater resistance of the viruses to heat, drying, glycerine, etc., and the extremely poor staining properties of the "bodies" and granules considered to be identical with the agent, when stained with the customary, powerful bacteriological stains. In all these important characters viruses agree in differing from bacteria.

That was still the position seven years after my first paper on this question was published (*loc. cit.*). Has anything more since become known about the biology of these viruses to justify assumptions that they *are* living organisms? The only biological points referred to in the present Report of the Council would seem, rather, to indicate the contrary. The immunological work of Gye and Purdy, for instance, on fowl-tumours, appears capable of explanation on lines similar to those on which Lumsden has already explained the results of his brilliant work on cell-toxins and antibodies in relation to malignant growths of mice and rats (*vide* [11]), though no comparison with this is made. In this latter case, there is certainly no question of any living organism being concerned; it is entirely a matter of cell-biology. And so it is doubtless, too, in the case of the fowl-sarcomata. And, indeed, this particular instance, as affording an example of a *living* "ultra-microscopic" infective agent, has been given up by practically everybody! Again, the Report points out that from Topley and Greenwood's immunological work on the new disease of mice, ectromelia, it would seem to be indicated that the process of herd-immunization in bacterial and virus diseases may be fundamentally different. It states as follows: "No opportunity has yet occurred of studying a mouse disease in which the type of immunity involved is anti-toxic rather than anti-bacterial. Experience with human diseases such as diphtheria and scarlet fever suggests that infections of this type would approximate in their behaviour to the virus diseases rather than to such bacterial infections as mouse-typhoid." Is there not here the implication of a "toxic" *principle* as the main factor in the virus infections?

At the present time, many workers on these viruses, having entirely failed to obtain a positive clue from experimental methods, cultivation, etc., are now tending to rely on microscopical observation in the endeavour to arrive at the real nature of the causal agents. And the determination of the very minute size of some of the particles which can convey the infection is, of itself, on biological grounds, a strong point against their being living elements. This is, indeed, recognized in the Council's Report and the possibility of at least one virus agent, that, namely, of foot-and-mouth

disease, being of inanimate nature is admitted. Now, if this admission is made in the case of one virus-disease, it is surely only logical to admit the same possibility in the case of the others, *especially when it is considered how many biological features they have in common!* Yet, apart from this one instance, the Report states that "all the evidence accumulated by the use of refined new methods, such as ultra-filtration, ultra-microscopy, tends to reinforce the opinion already widely held that some, at least, of the viruses are definite, self-reproducing organisms." I venture to disagree strongly. The mere detection of the finest infective particles of these viruses does not carry us, really, any nearer towards determining their nature.

I pass now to a consideration of these granules themselves, and will endeavour to answer the objection that there is no cogency in my view as to their nature.

Cytological and Microscopical Points.

The size of these ultimate particles varies in different cases, from $0{\cdot}2\,\mu$ to $0{\cdot}3\,\mu$ (in the smallest "Rickettsia" bodies, e.g., of typhus) and $0{\cdot}2\,\mu$ to $0{\cdot}25\,\mu$ (in the case of the Paschen granules of vaccinia), downwards to $0{\cdot}07\,\mu$ (in the case of the fowl-sarcoma virus), and probably still less in the case of the bacteriophage particles. It is important to remember, however, that, at any rate as regards the larger granules, this is only the *ostensible or apparent* size, as they are seen when "loaded" with Romanowsky stain, for which these protein particles have an intense affinity, and which undoubtedly enlarges them far beyond their true size. This is, indeed, admitted by Eagles and Ledingham in the case of the Paschen particles, for which they give an estimated "real" size of about $0{\cdot}15\,\mu$ (according to Elford). And a similar error applies equally, it must be borne in mind, to the measurements given of the "Rickettsia" bodies, which have always been detected with readiness (because of their abundance) in ordinary stained smears.

Moreover, there are two very important points in connection with this red or reddish-lilac staining of particles with Romanowsky stains to which reference must be made—even again, for I have already dealt with this point (*vide* [19]). But, as was indicated there, these points are *still* being continually overlooked, and *no real progress is possible in this granule question until they are driven home to all workers upon this subject* (*loc. cit.* p. 76). Now that, as mentioned above, bacteriologists are finding themselves almost driven, as it were, to microscopy for the determination of the nature of these virus agents, it is more than ever requisite that the expert knowledge of the microbiologist, with his biological outlook and true cytological methods, should be properly appreciated. There is, first, the colour which these granules stain, which, as indicated, is quite different from the intense purple-blue, almost blue-black colour of bacteria when so stained. Even Rocha-Lima, an upholder of the organismal nature of "Rickettsia" bodies

was considerably exercised in mind by this very difference. Secondly, there is the well-known fact that the Romanowsky stains are *not* selective for chromatin. Granules of protein substances which are not chromatin often show an intense affinity for these stains. For example, the nucleus (trophonucleus) of a trypanosome, when stained with Giemsa, appears to consist of a mass of small granules. But these do not constitute the chromatinic elements of the nucleus, the true structure of which is, indeed, as different as possible from the false impression thus created. All the chromatin is contained in a central karyosome, surrounded by nuclear sap. This latter shows no granules when stained by cytological methods; nevertheless, the very fine "ultra-microscopic" colloid, protein particles in this sap, when "loaded" with the Romanowsky stain, appear as a number of definite grains, and were regarded as the nuclear chromatin until this peculiarity of this staining method became realized. Again, metaplastic granules, the by-products of cell-metabolism, also have a strong affinity for these stains. As a very pertinent instance, the so-called chromatoid granules of a trypanosome may be cited. Because, in the case of one particular, admitted, "Rickettsia," that, namely, of the sheep-ked, I have shown that, to a very large extent, this is merely the masses of these granules liberated by the disintegration of dead crithidial forms of the sheep-trypanosome which occur in vast numbers in the intestine [20].

Next, as regards the question of their "behaviour" in an organismal sense, i.e., as regards multiplication (division) and so on. The Council's Report states that in the case of the minute particles representing the infective agent of the mouse disease, ectromelia (which are estimated to be only about $0{\cdot}1\ \mu$ to $0{\cdot}15\ \mu$ in diameter), "some forms of these submicroscopic cocci have been seen which suggest the manner of multiplication by fission." It is true this is a very modest statement when compared, for instance, with the elaborate life-cycle originally described by Gye and Barnard for their cancer organism. But how much credence can really be given to it; to how much does it really amount? The multiplication or division of a living organism is a definite, *positive* act, a normal sequel to growth and increase of size. Now trituration, comminution or fragmentation—whatever it may be called—is a well-known phenomenon, induced by outside conditions or circumstances, of frequent occurrence in the case of globules or spherules of liquid or semi-solid, non-living matter. This is of course a "negative," or non-voluntary act. Mercury may be cited as a common example. And I have found, beyond any reasonable doubt, that this is what occurs in the course of the production of the fine "Rickettsia" granules in the intestine of the louse. Discrete spherules, $1\ \mu$ or $2\ \mu$ in diameter, of pigment, are abundant. They have been moulded into this form, simulating cocci, by the breakdown of the amorphous hæmoglobin masses, as these become altered and of thicker consistency in the course of the digestion. These pigmentiferous spherules continue to "divide," becoming smaller and smaller as the physical and chemical conditions of

the medium alter and the contents of the intestine undergo continual churning and friction. Concurrently, in the later stages of the digestion, owing to the pathological action of the abnormal hæmetabolic enzyme, a further change takes place in the constitution of these small comminuted pigment-granules, the iron-containing moiety being separated and lost and the residual protein material, now staining reddish, or reddish-lilac with Giemsa, being left as minute "Rickettsia" granules, the ultimate product of the pathological hæmetaboly. All this process has been described in detail in my paper on the subject [21].

Various Types of "Bodies."

Now, with this actual example before us, what reason is there to suppose that a comparable disintegration and comminution of other virus "bodies" and granules does not occur? In the present enthusiam for these fine, ultimate particles, there is *a tendency to forget* the known, conspicuous, diagnostic "bodies," which have long been associated with certain virus diseases. But these are still there and have to be taken into account! I will refer especially to two, the Negri-body (occurring in hydrophobia) and the Guarnieri-body (occurring in smallpox and vaccinia), both of which are now generally admitted to be, not parasites or living organisms of any kind, but cell inclusions. With these may be included the Kurloff-body, which, though not pathological, is a characteristic formation found regularly in the guinea-pig, occurring more or less frequently in the lymphocytes. In the case of the Negri-body and the Kurloff-body, I have shown [17] that so far as microscopical evidence can be certain, both these are the result of hæmetaboly, pathological in the one case, normal, but of an exceptionally unusual type in the other; that is to say, these peculiar bodies are formed by the alteration or incomplete digestion of hæmoglobin by some pathogenic or unusual enzyme. They are *essentially similar* formations, consisting of inclusions (or "inner formations"), most probably representing the "globin" portion [1] of the hæmoglobin, which are enclosed or contained in a mass which consists of the iron-containing portion. This mass, constituting the whole "body," is either of a fairly solid consistency (as in the Negri-body), or else liquid (as in the case of the Kurloff-body, when it is dissipated in the course of the preparation of a dry smear, leaving behind the inclusions apparently in a vacuole). The size of the body, which is variable, depends, in either case, entirely upon how much corpuscular material has been included in the particular little mass.

Now further, as regards the Guarnieri-bodies, it is apparent beyond doubt, from certain of the excellent microphotographs given long ago by Councilman, Magrath and Brinckerhoff, in their collected studies of variola and vaccinia [3], that *many* of the Guarnieri-bodies are also the same type of formation. It will be noticed that I do not say that all of these bodies

[1] This must be altered in some way which renders it insoluble, at any rate in the various media used in making preparations

are formed by this characteristic splitting up and alteration of hæmoglobin. Because in the case of the ectodermic epithelium in these conditions, the cells *also* ingest and abnormally metabolize leucocytes, the resulting pictures of the "bodies" then being not only more variable, but less well defined. Thus both Ewing and Salmon were, in a measure, right in the view they took of the nature of these formations. Nevertheless, in the earlier stages of the derangement, the epithelial cells most probably ingest and alter red blood-corpuscles before they are stimulated to attack leucocytes; just as in the case of the normal skin, hæmetaboly is mainly of the corpuscles (with pigment production) and only very occasionally are leucocytes taken in.

I have recently come across an account of certain early observations of von Prowazek, which were made upon fresh preparations of rabbit epithelium, containing Guarnieri-bodies, and these are so suggestive from the above point of view, that I propose to extract the following sentences from his paper [14]: "Im frischen Präparat besitzen die jüngsten Guarnierischen Körper ein opakes Aussehen und liegen oft dicht dem Kern an, wobei sie nicht etwa eine Tropfenform annehmen, sondern sich halbkugelförmig der Kernmembran anschmiegen, eine Tatsache die nicht fur eine vollkommen leichtflüssige Beschaffenheit der fraglichen Gebilde sprechen würde. Später runden sie sich mehr ab und man kann an ihnen nun eine dichtere, etwas lichtbrechendere periphere Kontur, der nach innen zu auch verschiedene Granulationen anliegen, und *einen mehr flüssigen Inhalt feststellen.*" (The italics are mine.) "In vielen Körpern beobachtet man . . . 1-2 und mehr meist hantelförmig oder stäbchenartig gestaltete Initialkörper, die keine deutliche Struktur erkennen lassen und ein lichtbrechenderes, sehr leicht grünlich schimmerndes Aussehen besitzen."

Bearing in mind that Prowazek was preoccupied with the idea that a living, parasitic organism was concerned, and making allowance for this, is it not nevertheless clear that he was observing actually a very similar formation to the Kurloff-body? In the above instance, he was observing the "youngest stage," that is to say, a single included corpuscle (this is evident, indeed, from the figure accompanying his description). The "body" is evidently for the most part liquid or slightly viscous in consistency (as is the principal mass of a Kurloff-body), and surrounded by a membrane, the corpuscular "skin." For this reason it does not always have the form of a spherical "drop" (although, in Prowazek's figure referred to, it actually has), but may be flattened to one side, where it abuts on the cell nucleus (c.f. my fig. 11, *loc. cit.* of a Kurloff-body). The "Initialkörper" are the inclusions, one, two or more, which appear in the altering hæmoglobin as the protein elements become separated from the liquid, iron-containing part. The superficial granulations mentioned are a feature which are also to be observed very commonly in the Negri-body; and, under certain circumstances, I have observed them in the Kurloff-body. So much, then, for the ordinary Guarnieri-body.

(To be continued.)

INOCULATION AGAINST INFLUENZA.

By Major R. A. MANSELL, M.B.E.,
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The value or otherwise of vaccines as protectives against colds and influenza remains still a matter of some doubt and one on which few seem to care to pronounce a definite opinion, either as regards individuals or in reference to groups of individuals; this is particularly so when communities are concerned and use has to be made of a "stock" vaccine. One gathers from the writings on this subject generally that there is a slowly increasing weight of opinion favouring the proposition that such inoculations have a considerable prophylactic value (considering communities rather than individuals) against infections of the air passages and their adjoining sinuses; and, perhaps too, against many of the complications of true influenza. Such controversies as this can only be settled by the accumulation of evidence from all possible sources, and its final assessment by those competent to judge the matter from every point of view. The chief criticisms which have been, and may be, levelled at some of the reports on this method of prophylaxis are that some bias in one direction or the other is evident throughout, and that no true experiment has been made in that there has been an absence of true "controls." It is hoped that in what follows most of the possible faults and fallacies will be frankly admitted so that the reader may have a clear opportunity of forming, or possibly modifying, an opinion for himself.

The "experiment" now to be discussed was initiated and encouraged by Colonel H. B. Kelly, D.S.O., A.D.M.S., of the Wessex Area (West), before my arrival in the area; my part in the matter is simply that of a recorder. I have tried to set forth the figures which follow in such a way as to leave them intelligible to all, and not open to the accusation that a hygienist let loose on figures can produce any result he pleases. These figures have been collected from a number of medical officers whose actual diagnoses and standards may, of course, differ; but the instructions which have been issued and the assessments which have been made have aimed at the inclusion of all cases which should, reasonably, be included in such an inquiry. The figures which were collected have not been manipulated, and no differences in environment, duties, or in any other factor have been made between the inoculated and uninoculated individuals.

The military garrisons in this area are housed in barracks in, or in close relation to, towns; the personnel under discussion mix freely with the civilian population, and no restraint has been placed upon them; the children attend the local civil schools. The soldiery have, however, this advantage, that there is not overcrowding in their barrack rooms, nor, generally, in their married quarters; supervision is exercised over the

ventilation of the barrack rooms and institutes, especially when they are fully occupied at night time, and over the proper spacing of beds so as to provide at least six feet between heads. Attention has been directed to the protection of men from the ill-effects of undue exposure to chill and damp; in particular, the wet scrubbing of barrack-room floors has been strongly discouraged and the substitution of staining and polishing has been recommended, and, in the majority of cases, carried out. In the barracks of one Infantry Depot the regular daily spraying of institutes with ten per cent formalin solution has been carried out, as suggested in correspondence in the *British Medical Journal* (Nos. 3705 and 3706, January, 1932), but I do not find any reason for supposing that this markedly influenced the results either locally or as a whole.

The numbers of these catarrhal and bronchial affections vary considerably year by year, and are influenced by many factors, the majority of which, and possibly the most important, are outside our control—the weather of the particular season and, too, of the preceding summer; the expectation of influenzal infections considering the general cyclical nature of such epidemics and the probable occurrence of maximal points in these cycles at unfavourable seasons of the year, and so on. This year there has been, in this area, nothing approaching an epidemic, though viewed generally, the figures have been on the high side. All the evidence that one has is, however, strongly to the effect that such infections have been fewer, proportionately, amongst the military than in the civilian population.

At the beginning of October, 1931, the desirability of inducing all ranks and their families to undergo inoculation for the prevention of colds was impressed upon medical officers; subsequently the matter was brought closely to the attention of commanding officers and men. About one-sixth of the population concerned responded (Table I). The mixed cold vaccine prepared at the Royal Army Medical College was employed, and it was recommended, as the result of previous experience, that protection should be considered to consist of three successive doses of $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ cubic centimetre. No inoculations were performed after the end of December; the great majority well before that date. The records below

TABLE I.

	Inoculated with			Not inoculated	Total
	one dose	two doses	three doses		
Officers	6	3	10	148	167
Women and children	3	4	39	1,047	1,093
Other ranks	39	48	577	2,288	2,952
Totals	48	55	626	3,483	4,212

relate to the period, January 1 to March 31, 1932; the period of expected maximal incidence of these infections.

The numbers of individuals concerned in this investigation are shown in the preceding table.

Records for the period January 1 to March 31, 1932, the period of expected maximal incidence of bronchial affections and influenza, show the results set forth in the following tables.

TABLE II.

	Average strength	Incidence per 1,000 of "colds" and influenza amongst persons:— fully protected by three doses of vaccine	not protected by inoculation
Officers, women and children ..	1,260	20·41	48·53
Other ranks	2,952	27·71	90·09
All ranks and families	4,212	27·15	76·34

A further analysis of these records shows that if the full course of three inoculations is not completed the individual's resistance to infection is not improved to anything like the extent that might, at first sight, be expected. In fact, the results of the partial protection afforded by the two small doses might appear to indicate that such a procedure is definitely harmful: the actual figures, however, are so small that they are open to too many sources of statistical error to be of any use.

TABLE III.

	Incidence per 1,000 of "colds" and influenza amongst persons who received:—			
	one dose only	two doses only	full three doses	no inoculation
Officers, women and children ..	222·22	571·43	20·41	48·53
Other ranks	51·28	187·50	27·73	90·09
All ranks and families	83·33	236·36	27·15	76·34

Even if we admit the groups of individuals who did not receive the full course of inoculation, and who were, both from the point of view of reliable statistics and from that of effective preventive medicine, in an unsatisfactory state—that is to say, if we make the worse case we can out of the figures in question—a very definite advantage is obvious in the use of this vaccine when applied to communities.

TABLE IV.

	Incidence per 1,000 of "colds" and influenza amongst persons who received :—	
	one, two or three doses of vaccine	no inoculation
All ranks and families	47·95	76·34

It is a claim of hygienists as a whole, I think, that they work, eventually, for savings—savings of health, efficiency, happiness and money. The figures given above do show savings: what is their effect on the public purse?

The cost to the State of a soldier under treatment in barracks must, if we look at the matter from all sides, be infinitesimal. Medical establishments have to be maintained in peace, apart from all other considerations, in order to be ready for war. The actual cost of the drugs used per sick soldier treated as an out-patient for a disease of the nature of those under discussion cannot be large, and is probably not appreciable in comparison with the necessary expenditure on the maintenance of an effective army. The loss in training days may be very considerable, but it can scarcely be said, speaking generally, to interfere largely with the production of the fully trained soldier—considering the Army "*en masse*." Similarly, treatment in Reception Stations, in the final event, costs very little except the expense of drugs, the washing of hospital linen and some part of the depreciation of stores of a semi-permanent nature. Actually no figures are available regarding the cost of treatment in Reception Stations: the labour of obtaining such figures at the present moment has not seemed quite commensurate with the possible results. Hospital treatment in this area—that is admission to the Royal Naval Hospital, Devonport—costs 10s. 6d. a head daily as a direct debit against military funds. Laboratory and other investigations are charged in proportion. In military hospitals treatment may cost more or less than this sum; possibly, in view of the facts noted above, it costs, in the long run, less. Nevertheless, we have here only one readily available and reliable figure on which to work. The application of such a local cost to other stations, and, more so, to the whole of the Home forces is admitted to be open to severe criticism: it is made only to demonstrate how a simple prophylactic procedure, soundly based, may in the end be—and, in fact, usually is—a source of real all-round saving.

The figures given in the preceding tables may now be further analysed.

The cases which were treated in Reception Stations had an average duration of 3·62 days; those treated in the Royal Naval Hospital of 7·93 days.

The tables which follow apply only to the group of other ranks. It is admitted that the two sets considered are not strictly comparable; statistically, the comparative values of the series of inoculated (577) and of non-inoculated (2,288) men are, roughly, as one to two—being of comparable value in proportion to the square roots of the figures concerned. As claims are to be made for the three-dose system in preference to others, and as those who received fewer doses could scarcely be held to have received valid protection, I am dealing now only with the fully protected and the unprotected.

TABLE V.—UNDER TREATMENT IN RECEPTION STATIONS.

	Inoculated	Not inoculated
(1) Number of cases	10	130
(2) Total days' sickness	36·20	470·60
(3) Ratio per thousand	17·33	56·82
(4) Cases at 56·82 per 1,000 ..	32	130
(5) Days' sickness at 56·82 per 1,000	115·84	470·60
(6) Saving in days' sickness ..	79·64	—

TABLE VI.—UNDER TREATMENT IN HOSPITAL.

	Inoculated	Not inoculated
(1) Number of cases	6	78
(2) Total days' sickness	47·58	628·54
(3) Ratio per thousand	10·39	34·07
(4) Cases at 34·07 per 1,000 ..	19·7	78
(5) Days' sickness at 34·07 per 1,000	152·22	628·54
(6) Saving in days' sickness ..	108·64	—

Total days' sickness saved in the inoculated group (577 men), on the assumption that had they not been inoculated their sick rate would have been that of the uninoculated = 188·28 days.

If, on the other hand, we look at these figures from the other aspect and consider the uninoculated group of 2,288 men and the inoculated group of 577 men together as if they had all been inoculated and had the morbidity rates of the inoculated group—i.e.: 17·33 and 10·39 per thousand for treatment in Reception Stations and Hospital respectively, we get, for the total 2,865 men, the following:—

TABLE VII.

	Reception stations	Hospital
(1) Number of cases	51·07	30·63
(2) Total days' sickness	184·87	242·90
(3) Total days' sickness	427·77	

Presumptive saving of days' sickness by comparison with the preceding Tables VI and VII = 755·15.

Applying costs to the figures for treatment in hospital (10s. 6d. per patient day) the figures in Table VI, item (6), show a direct saving of

£57 0s. 8¾d. in the group of 577 men; and from Table VII we can estimate, for the whole population concerned, a possible saving of £227 8s. 9½d.

The cost of the vaccine used was £1 13s. per 100 c.c., which is sufficient to give (say) sixty-five men the three doses recommended, allowing for normal wastage in use.

In this series of 577 men the cost of the vaccine was £14 10s. 5d.; the gross estimated saving of hospital charges was £57 0s. 8¾d.: the nett saving therefore works out at £42 10s. 3¾d.

Looking at the matter from the point of view of Table VII, which deals with possibilities, the cost of the vaccine would be £72 14s. 7d.; the gross saving of hospital charges £227 8s. 9d.; and the nett saving £154 14s. 2d. on a garrison of 2,865 men during the three months of the "cold" and influenza season.

To carry this to its conclusion, and I have fully admitted its openness to criticism: supposing that the "other rank" garrison of all Home stations is some 95,000, the nett savings attributable to inoculation prophylaxis of these infections can be estimated at some 25,000 men-days and £5,105.

I want again to emphasize that I claim nothing for these figures but that they are openly recorded for criticism: many of the possible fallacies have been pointed out to the adverse critic, who will doubtless discover more. To help him, and to make the picture more complete, it must be stated that the persons who received inoculations were volunteers and must necessarily be so in the Army at present. No attempt could therefore be made to institute any real system of controls by having proportions of each class in each, or any, barrack room, or even by having equivalent proportions in individual units. It may well be suggested that those who volunteered were the men who are normally more careful of their personal health; the reply appears equally open that they were those who normally suffered excessively from colds and who, from the previous experience of others or as the result of the eloquence of their advisers, clutched at the straw which was floated before them. I have no evidence in either direction.

Inoculations in the Army are undoubtedly troublesome to everyone from the man's commanding officer downwards; the difficulty of completing multiple inoculations satisfactorily may be taken to be more in proportion to the cube of the number of operations to be performed rather than as having any direct relationship to that number; so that when a triple inoculation is in question there must be a very strong conviction, forcibly put with a firm tenacity of purpose, in order to overcome the natural inertia of the other party. Such a conviction has been achieved in the case of the enteric fevers, and units abroad now boast, in large numbers of instances, of one hundred per cent protection by double inoculation.

A soldier receiving an inoculation is considered to be entitled to a period of release from full duty, both to allow him to recover from the

reaction and also as some form of inducement to undergo the operation. It is, therefore, permissible to subtract the sum of these periods off duty from the savings of men-days' sickness resulting—or appearing to result—from the procedure, and so to alter the figures given in the tables above as to make them unrecognizable. I do not feel that this is the place to enter fully into this part of the argument ; it is a lengthy one. In the end it works down to the question of whether we prefer a healthy Army or a sickly one ; and whether or not we have here a true method of reducing sickness.

"OLLA PODRIDA."

By Lieutenant-Colonel W. MITCHELL, O.B.E.,
Royal Army Medical Corps.

What a wealth of situations the average officer in the Corps is called upon to appreciate in his many and varied wanderings round the face of the globe! To the senior Major an appreciation means a harrowing experience in the wide open spaces, with tactical problems to suit the situation set by a Board who are keen to know the correct solutions. To a junior, especially in India, wards full of cases, temperatures soaring to the skies, entero-dysenteric symptoms and complications to suit, each of which demands an appreciation. The regimental ward orderlies' assurances in the early morning that all the stools are negative and that no "parachutes" have been found in the blood helps little, and so hours are spent endeavouring to solve a problem of great importance as regards diagnosis and treatment.

Inter alia the inspecting officer arrives, and pomp and circumstance take precedence over all other cares. All is prepared. His idiosyncrasies and pet problems are carefully studied beforehand. The situation duly appreciated—the "big stuff" is served by all concerned. Some of us are thinking of leave home, and on the result of the inspection we frame our hopes. Having seen everything the inspecting officer decides to peep into a ward cupboard, along the shelves of which he runs a prying finger. Out it comes covered with dust (which has been put there beforehand for him so to find) to the embarrassment of the ward sister and to the annoyance of the matron, who remarks to her O.C. in *sotto voce*, "his mother must have been a housemaid." Her appreciation may or may not be correct. Why worry!! He is pleased with the discovery, all goes well and in due course we get our leave.

The boat conveying us home is palatial, new, modern and jerry built. Tennis courts, swimming pools, cocktail bars, dance halls and all complete. Music, gramophones, dances, sweeps, the "dogs." Sweet young things in Lido "knick-knacks." All and sundry. Hoi and very much polloi—1,100 souls fleeing from the heat of an Indian summer (*sic*). What a wealth for the student of types to appreciate! My room mate—a taciturn tea planter—comments as we leave the Ballard Pier, tersely and thusly—"We now depart from the land of rice, pice, lice and vice," and says no more till on a cosy morning in the Red Sea, whilst nonchalantly leaning on the palings and contemplating a distant heat haze, he queries, "Tell me is that land or liver." His appreciation, incorrect in the first place, is possibly true in the second.

A heated discussion at table one night causes a Sassenach member of the Corps to asseverate that "all you Scots and Irish are merely soldiers of fortune, mercenaries, hirelings." Well, it may be true. History, language and dialects prove that our forebears soldiered in the wars and on the side of many of our continental brethren, viz., as mercenaries, and so why not continue to the benefit of the whole? As a result the Scot's dialect has been enriched by many expressions and delightful terms now part and parcel of our language. Our Scots association with the French, in soldiering, smuggling, religious wars, exilings and returns, the '45 and what not, is markedly evident. To appreciate——

On the morning of my return home on leave the breakfast table was graced by a Scot's delicacy known as a "bap" and sold as such. Merely a flat white morning roll and consumed in many if not all Scot's households at breakfast. A descendant of the French morning roll or "bas pain."

Should any of you be on tour in Scotland visit a pastry cook's shop and ask for "petticoat tails." You will receive delightful small shortbread cakes. Why the name? The pastry-cook's forebears came from France or learnt their cult there and made similar delicacies, but these were known as *petites gatelles*.

The Scots medico may remember his landlady in his student days bringing in his "jigot" of mutton on an "ashet." She may have been unaware of such terms as *gigot* or *assiette*.

A thesis on appendicitis surely would be incomplete without reference to the "Eleck Pooshun," a disease known to the good wivies of Fifeshire many many decades ago. The surgical specialist's appreciation would be "Iliaque Passion" (Fr.) or stoppage of the bowel.

Western Gailes in Ayrshire is a golfer's paradise. Fairways and greens of glorious springy turf with the feel of a Persian carpet. Arran in the distance, sea, surf and sandy beaches nearby. The rough, also nearby, real tiger country. Complete in "Fourings" with hope, clubs and a pawky ex-soldier caddie, I essayed a round. After much effort in the rough my caddie suggested, "Why don't you try the coorse, surr, it's much easier than a' that danderin'." A correct appreciation. But did he wot of the term "dandiner" to wander aimlessly.

In Edinburgh, Kirkcaldy, St. Andrews, etc., are small streets known as "vennels." Therein of an evening can be found gangs of youngsters playing their noisy street games with shrill and shouting voice. Picture an irate mother emerging from her household cares "Awa' ben!" and espostulating with her young hopeful in the following terms: "That's an awfu' cannalie ye are wi'!" (Vernacular for: "What a mob you are playing with!") Her forebears came back from France some centuries ago with such terms on their tongues as *venelle* (a small street) and *canaille* (a rabble).

"Gawky" loons or "gowks" from the same venelles go out with catapults and in the woods shoot at "corbies." Possibly their great-great-

grandsires talked of "gauche" and "corbeau." Merely now a matter of pronunciation.

One of the interesting features in a train journey up country in India is the arrival at a large railway station. The sweetmeat, fruit, flower, toy, and other vendors pass and repass the carriage windows and in sing-song voices proclaim their various wares. Gifted with a very small knowledge of Urdu, one is liable to appreciate their offers and requests erroneously. Such was my first experience. "Mussulman pani pio," I interpreted to be a polite request on hygienic grounds for the Mohammedan to descend and pass water. Similarly until recently I thought that the old time "Dooly" man was something connected with the Indian "dhooly" or litter. Not so. Early in last century, perhaps earlier, the Dooly man hawked his milk through the streets of Edinburgh. The "du lait" man in fact.

Burns, when writing "John Anderson my Jo, John," did not mean his Jo to be interpreted as a diminutive of John. Far from it; rather as "Joie,"—my delight, my dear.

Nowadays, when one is approaching retirement, one studies the advertisements in various periodicals wherein are depicted desirable residences for sale—garden, golf, indoor sanitation, h. and c., etc., with particular emphasis on drainage and baths. Such problems did not affect the denizens of the High and other streets of Edinburgh in the preceding two centuries. With a cry of "Gardyloo," the indoor sanitation (or lack of it) became outdoor. From high up in the housetops, with her preliminary cry of warning—"Gardyloo"—(*Gardez l'eau*), the housewife hurled her excremental offertory into the street below. Passers by, irrespective of knowledge of French or otherwise, took cover or, if such were then in existence, put up their umbrellas.

Now Jean is a common name in Scotland, especially in Edinburgh and, possibly, the High Street. Picture the Jeans high up in the housetops of the High Street, taking due precautions without representations in the sanitary diary. Were they the precursors of our present Hygiene Department?

Obituary.

SIR RONALD ROSS.

THE death of Sir Ronald Ross removes one of the greatest benefactors of mankind—a man who, while not a trained biologist, by sheer genius and power of work, made discoveries which are now the basis of the preventive measures against malaria.

Ross had heard of Laveran's discovery of the malaria parasites, but failed to find them in the blood of cases of malaria in India owing to faulty technique and the inadequacy of Laveran's drawings. But after a visit to England, when Manson showed him the various malaria organisms and suggested that mosquitoes carry malaria just as they carry filariæ, Ross determined to return to India and there endeavour to discover whether the parasites were taken up by mosquitoes from malaria cases and what, if any, changes they underwent in the stomach of the fly.

Ross was very ill-equipped when he commenced his researches; he had not been able to obtain any books on mosquitoes, so he made his own classification; he had not even heard of the Romanowsky stain then in use for demonstrating malaria parasites. Moreover, the official world in India did not evince much interest in his work, and when he applied for an extension of leave to continue his investigations, he was sent to Secunderabad. A little earlier he had written:—

> "By what we have we lose;
> By what we have not, get;
> And where we cannot choose
> The crown of life is set."

So it was indeed. He had to return to Secunderabad; and there two months later the Great Problem was solved!

In his Memoirs Ross tells the story of his great discovery of the zygotes in the stomach of a mosquito (*Anopheles stephensi*). How, after days of unremitting toil, when exhausted by heat and want of sleep, he saw "the female crescents themselves which had been fertilized by the sperms of the male crescents and were now beginning to grow, still containing their original pigment, in the gastric cells of the anopheles." On that fateful day—August 20, 1895, the anniversary of which he always called Mosquito Day—all his trials were forgotten and he scribbled in one of his notebooks the following verses:—

> "This day relenting God
> Hath placed within my hand
> A wondrous thing. And God
> Be praised. At His command,
>
> Seeking His secret deeds,
> With tears and toiling breath
> I find thy cunning seeds,
> O million-murdering Death."

In spite of all the research work that he had done, Ross saw no prospects in the Indian Medical Service, so he retired on a pension and came to England. During the next twelve years he lived a very arduous life; the value of his researches became generally recognized, and he was appointed director of many expeditions to tropical and semi-tropical climates in the fight against malaria. His work at Ismailia was considered one of the finest examples of the application of scientific knowledge to preventive medicine.

Unfortunately, to the very end of his life Ross believed that not sufficient use had been made of his discovery as a means of eradicating malaria. His last years were spent in an endeavour to awaken more active interest in mosquito work and methods of prevention. He did not spare his opponents and took no account of the bitterness his attacks so often aroused.

Ross was a shy man with a brusque manner; but those who had the privilege of working with him realized the originality of his mind and the goodness of his heart. Although much of his life was passed in comparative obscurity, his name will never be forgotten, and his discoveries will rank in practical service to mankind with those of Harvey, Pasteur and Lister.

Editorial.

THE LISTER INSTITUTE OF PREVENTIVE MEDICINE.

The Report of the Governing Body of the Lister Institute issued in May, 1932, contains an interesting survey of the research work carried out in 1931.

In previous Editorials we have referred to the fact that Professor Ledingham has succeeded by a special method of extraction in securing from the raw material of the lesions of vaccinia and fowl-pox pure suspensions of the Paschen and Borrel bodies. He has found that experimental animals (rabbits and fowls) after inoculation with the respective viruses of vaccinia and fowl-pox develop specific agglutinins for these bodies. After a dose of vaccinia virus agglutinins for the Paschen bodies appear in the blood-stream about the fourth or fifth day; there is a rapid rise to a fairly high maximum titre, followed by a gradual fall. The agglutinin response follows much the same course as that observed after inoculation of a dose of bacterial or other protein.

Dr. Amies, a Research Fellow in Bacteriology, is extending this field of work and tracing out the development of Paschen bodies in the serum of man and monkey, after inoculation with vaccinia virus. He is also occupied in investigating by serological means the relation to each other of the viruses of vaccinia, cow-pox, variola and alastrim.

Professor Ledingham, Dr. Morgan and Dr. Petrie have found that the antiviral body in a horse immunized with vaccinia virus is associated with the euglobulin and pseudoglobulin fractions of the serum, but none is present in the albumin. The serum when given simultaneously with the virus was found to be very effective in controlling infections of rabbits with strains of virus of cutaneous and testicular origin.

Dr. Eagles and Dr. McClean have continued their endeavours to propagate vaccinia virus in serial subculture in a cell-free medium. In a kidney extract mixed with fresh rabbit serum and Tyrode's solution, a neuro-testicular strain of virus has been propagated through ten subcultures and an increase of 10^{20} obtained over the original inoculum. Dr. Ledingham found elementary bodies in the third and eighth subcultures, but none in the unincubated controls and the virus-free medium.

By centrifugalizing in a high-speed centrifuge at 14,000 revolutions a minute a vaccinia virus filtered through a Berkfeld V candle, Dr. Ledingham obtained a deposit which was potent when injected intradermically in rabbits. The supernatant clear fluid was quite inactive. The deposit was found to consist almost entirely of Paschen bodies.

The prophylactic value of anti-plague vaccine has been studied by Dr. H. Schütze, who has found that the plague bacillus contains two antigenic components; one that develops at 37° C. is contained in the gelatinous envelope which, as Rowland showed, encircles the bacillus only when grown at this temperature. If a vaccine is to have a high potency it should contain this envelope substance in adequate amount. Cultures should therefore be grown at 37° C. instead of at 26° C. By employing this method a vaccine can be prepared which will protect 50 to 100 per cent. more of the inoculated animals than would a similar vaccine grown at 26° C.

Dr. Schütze has also shown that the *Bacillus pestis* has a somatic antigen which is not species specific, but is identical with one portion of the somatic antigen of *B. pseudotuberculosis rodentium*. It is suggested that this antigen is a rough somatic constituent and that the *B. pestis* is in effect a rough organism.

A serological investigation of *Vibrio choleræ* and allied vibrios has been carried out by Dr. Gohar. From this work it would appear that there is complete serological homogeneity of a large group of typical non-hæmolytic strains; these are to be regarded as the true *V. choleræ*. Hæmolytic but culturally typical strains of the El Tor type have certain H and O antigen factors in common with the true cholera vibrio, but are never identical with it in these respects. Cross agglutination, particularly of the H types, is found between *V. choleræ* and quite atypical water vibrios. Dr. Gohar considers that the only certain diagnosis of the *V. choleræ* is that given by the absorption test.

Oral immunization with O and H antigens has been studied recently, and it has been shown that the serum of man immunized against T.A.B. by Besredka's oral method contains a considerable amount of the O agglutinins, but H agglutinins are absent. It was thought that possibly the gastric juice destroyed the H antigen, but Dr. Felix's experiments with rabbits, which have an acidity of the gastric juice of the same order as man, have shown that when vaccines of *B. typhosus* and *B. paratyphosus* A and B, containing both O and H antigens, are administered orally and subcutaneously there is no significant difference between the H and O agglutinins produced by the two different routes. The absence of H agglutinins in man immunized by the Besredka method is now supposed to be due to the method of preparation of the vaccine, the H antigen being destroyed during the process.

Recent researches on typhus-like diseases in different parts of the world have again brought into prominence the hypothesis that the typhus virus (Rickettsia) might be transformed into *B. proteus* X, a view which was put forward by Weil and Felix in 1921. Dr. Felix is making experiments with a view to conferring upon *B. proteus* X strains some of the properties

characteristic of typhus virus. The Kingsbury strain of *B. proteus* X is now considered as a variant derived from *B. proteus* X 19. The two strains differ as regards fermentation reactions and indol production, in addition to the diversity of their O antigens.

Changes in the endocrine organs of male rats kept on a diet deficient in vitamin A have been investigated by Dr. Korenchevsky. Animals suffering from vitamin A deficiency are sterile. In the testes the seminiferous tubes degenerate; the first sign is the disappearance of spermatozoa, then changes in the seminiferous cells are seen, degeneration being followed by the appearance of giant cells. The prostate and seminal vesicles are atrophied. The thyroids, in contrast to the testes, increase in size and weight, due to an increase in the number of the cells.

In recent Editorials we have referred to the new standards now being adopted for vitamins. Further information is now given as regards the standard vitamin A. Miss Hume and Miss Henderson Smith determined the minimum amount of material which will maintain a group of depleted rats for thirty-five days. Such minimum doses were found for the standard specimen of carotene and for special samples of cod-liver oil, butter and dried cabbage, issued by the Accessory Food Factors' Committee for comparison with the standard. The results obtained were in fair agreement with those of the workers in other laboratories, who had tested the materials by somewhat different methods, and seemed to justify the use of carotene as a standard. Further tests as to the stability of the carotene after storage for one year are now being carried out.

As regards the standard solution of irradiated ergosterol issued by the National Institute of Medical Research, Miss Hume and Miss Gaffikin, by using the results of previous investigations and new experiments, have constructed standard curves relating dosage to the response in bone calcification of the experimental animals. It is hoped that by the use of these curves an accurate estimation of vitamin D in unknown substances may be facilitated. Miss Hume's further work has confirmed the previous conclusions as to the stability of the standard preparation when preserved at 0° C. and its suitability for adoption as an international standard.

The standard antineuritic vitamin B, obtained by absorption on acid clay from an extract of rice polishings prepared by Professor Jansen, has been investigated by Dr. H. Chick and Miss Jackson. Using the growth method with rats they have found the standard to be highly potent (minimum daily rat dose about ten milligrammes) and convenient to administer. The stability was tested by experiments and no significant deterioration was detected after ten to twelve months' storage, whether at 0° or 37° C. Jansen's material has been found to contain very little vitamin B_2, and as it can be obtained in fairly large quantities it might be included

in basal diets designed for the study of vitamin B_2, rather than the concentrates now in use, many of which can only be obtained from yeast or other materials after elaborate preparation.

The standard of reference for vitamin C was decitrated fresh lemon juice prepared according to Dr. Zilva's method. When used immediately after preparation the material was found to be of uniform potency.

In further researches on vitamin A, W. Smedley-MacLean, Miss Hume and Miss Henderson Smith have endeavoured to ascertain whether the biological value of carotene as a source of vitamin A can be reliably inferred from the intensity of the yellow colour. This would appear to be the case, but it has been difficult to establish the point accurately owing to the instability of the already deteriorated and partly faded specimens of carotene which it is necessary to use for this purpose.

The origin and distribution in nature of vitamin D presents some interesting and as yet unexplained problems. Workers at the Institute have been examining the food sources from which the cod might derive this vitamin. From the habits of the fish it is unlikely that the vitamin could be derived from ultra-violet solar radiation. The green marine diatom Nitzschia, though rich in vitamin A, was found by Miss Leigh Clare to be devoid of vitamin D, and during the past year Miss Hume and Miss Gaffikin, working in collaboration with Dr. Atkins of the Marine Biological Station, Plymouth, have examined supplies of copepods which are believed to form a large portion of the food of the codfish during the spring and summer months. Only very small amounts of vitamin D have been found in the preliminary experiments with this material.

Work on the biological value of the proteins of wheat, maize and whole milk has been carried out by Dr. Fixsen, Miss Jackson and Dr. H. Chick. The experimental animal was the adult male rat and the biological value of the protein was estimated by determining the minimum amount required for nitrogenous equilibrium, an adequate supply of B vitamins containing minimal amounts of nitrogen being provided.

The proteins of maize endosperm have been found slightly superior in biological value to those of the endosperm of wheat flour, the figures being sixty-nine and fifty-eight respectively when these materials were fed at a seven per cent level in the diet. The proteins of the whole grains were found to be of about the same order, viz., about seventy at a seven per cent level. These results do not agree with those of other workers, who have found the biological value of maize proteins to be much inferior to that of wheat proteins, in fact to be the lowest found in the proteins of natural foodstuffs. Moreover, the Lister work does not give support to the theory that pellagra is due to the low biological value of the proteins of maize. As fifty per cent of the protein of maize consists of zein, which is deficient in tryptophan and lysine, the new experiments suggest that these deficiencies are supplemented by other proteins present in the grain.

Many workers have found that as the amount of protein in a diet is increased, its biological value appears to decrease, the utilization becoming less and less economical. Workers at the Lister have shown that this is not true of caseinogen, which appears to maintain a constant value when supplied in a diet over a large range of different percentages. This discrepancy between different proteins indicates problems in protein metabolism still unsolved and is being further investigated.

Experiments on vitamin C have been continued by Dr. Zilva, and he has determined the optimum amount of lead acetate to obtain the active fraction of lemon juice. If an excess of lead acetate is added in the process of fractioning, some vitamin C disappears from the medium.

Convincing evidence of the stability of the antiscorbutic concentrate prepared by Dr. Zilva has been furnished by the experience of Mr. Augustine Courtauld, a member of the British Arctic Air Route Expedition led by the late Mr. H. G. Watkins. Mr. Courtauld existed from December 6, 1930, until May 5, 1931, on a well-balanced but vitamin C-free sledge ration. For an antiscorbutic he took one dessertspoonful of the concentrate daily. He watched carefully for symptoms of scurvy, and though snowed up in his tent from March 22 to May 5, he never detected any signs and, apart from general discomfort, felt normal in every way. When relieved he was able to ski about one mile unaided from the ice-cap station to the relieving party's camp.

In previous Editorials we have referred to Dr. Zilva's researches on the presence of vitamin C in apples. By quantitative experiments on the Indian mango he has found that the pulp and the skin of the "Alphonso" variety are the most potent sources of vitamin C yet recorded. The "Cawasji Patel" variety is slightly less active in vitamin C, and the "Shendrya" variety contains much less than the other two varieties. The pulp of all three varieties contains vitamin A in quantities similar to that found in butter.

Dr. Petrie and Dr. Morgan have made some interesting experiments on the curative action of anti-pneumococcus serum. As was expected, they found that the curative effect is related to the time of administration of the serum, so that a dose of serum which is adequate to exert a curative effect when given twelve hours after the infecting dose must be increased one hundred times when the serum is given three hours later.

Dr. Petrie and Dr. McClean have been studying the toxin-antitoxin relations of certain diphtheroid strains isolated by Dr. Barrett from the human naso-pharynx and also of the bacillus of Preisz-Nocard (*B. pseudotuberculosis ovis*) which produces a toxin neutralizable to a certain extent by diphtheria antitoxin. The Preisz-Nocard bacillus seems to be closely related to the diphtheria bacillus, but a specific antitoxin appears to be difficult to produce. A horse which received serial doses of relatively

weak Preisz-Nocard toxin developed paralysis of the hind-quarters which resembled true diphtheria paralysis.

On the other hand, the three diphtheroid strains isolated by Dr. Barrett from throat-swabs seem to bear no relationship to the true diphtheria bacillus, since the toxin formed by them has none of the characters of diphtheria toxin and is not neutralized by diphtheria antitoxin. Injection of the toxin produced by the strains into the skin of the rabbit produces characteristic lesions, while a similar procedure has no effect on guinea-pigs.

Dr. Petrie has made some interesting observations on a precipitin reaction which occurs when varieties of smooth bacteria are grown on agar plates to which the corresponding specific serum has been added. After the colonies have grown for a day or two a halo appears around them, apparently due to a specific precipitate that is formed by the interaction of the bacterial polysaccharide and the antibody. The halo may take the form of concentric rings. The reaction has been obtained with the pneumococcus (Type I), *B. dysenteriæ* (Shiga), and Type I and Type II meningococcus.

The corresponding "rough" colonies do not seem to give the characteristic reaction. It is thought that the technique may prove useful in differentiating cultures whose smooth or rough character is not readily perceptible on ordinary culture media.

The extensive researches we have recorded indicate the valuable work now being carried out in the Lister Institute; for details of other research work which at present does not seem to have a bearing on practical medicine, we must refer our readers to the original report.

Clinical and other Notes.

THE TREATMENT OF SUSPENDED ANIMATION IN 1824.

By Brevet Lieutenant-Colonel R. PRIEST,
Royal Army Medical Corps.

The evolution of the treatment of malaria by the "bark" and later by the alkaloid now so commonly known, the evolutionary stages, too, of the treatment of amœbic dysentery by the administration of ipecacuanha, next by ipecacuanha-sine-emetine, and to-day by emetine, are examples of interesting historical studies. None the less absorbing is a stage in the evolution of the first-aid treatment of the apparently drowned, and it was when perusing the pages of an old medical treatise that I chanced upon a description of the treatment of suspended animation.

To those of us whose duty it is to impart the principles of first-aid to others in places where every modern adjuvant is at hand, or in places where improvisation is of paramount importance, I thought this extract would be of equal interest. Our medical ancestors were of necessity compelled to improvise, but it will be seen that although the general principles adopted in those far-back days were good according to modern standards, the methods of application would be considered to-day as being somewhat primitive.

The following extract is made from the "Medical Guide for the Use of the Clergy, Heads of Families, and Junior Practitioners in Medicine and Surgery. Comprising a Family Dispensatory and Practical treatise on the Diseases incident to the Human Frame," by Richard Reece, M.D., F.R.C.S., 1824 [1].

"The suspension of the vital powers, produced by immersion in water, called drowning, and that by strangulation and suffocation by noxious vapours and lightning, are very similar and require the same resuscitative means. As in poisons, what is necessary to be done must be done *quickly* and, on the *first alarm* the following articles should be got ready; *warm blankets, flannels, a large furnace of warm water, heated bricks, a pair of bellows, warming-pan, sal-volatile, clyster pipes and an electrifying machine.*"

Here follows the method of transportation of the patient to the treatment room and, on arrival :—

"The body being placed on warm blankets in a *spacious* room with a good fire and only five or six attendants, the first attempt should be to restore *heat* and *circulation* of the blood by friction with . . . and by placing bladders filled with warm water to the pit of the stomach and

soles of the feet. Ether and other spirits, recommended by the Humane Society for external applications, are *very hurtful*, . . . the cold produced by evaporation counteracting the effects of the friction.

"The restoration of the functions of the lungs should be attempted by forcing air from a bellows through one nostril, the other and the mouth being kept *closely* shut, and an assistant should gently press down the ribs . . . to imitate natural respiration.

"The brain and heart should be stimulated by passing through them the galvanic fluid. For this purpose Doctor De Sanctis, an eminent physician of London, has lately invented a cheap galvanic apparatus which is accompanied by instructions *to enable any person to use it*[1] . . . this remedy is of such importance, that the apparatus should be *kept in every parish*.[1]

"The bowels should be fomented and stimulated by throwing up of warm water with a handful of common salt dissolved in it, which may be done with a clyster pipe and a bladder. The injection of tobacco fumes up the fundament, recommended by the Humane Society . . . is likely to be more *hurtful* than otherwise. A slight agitation of the body every six to ten minutes will act as a great auxiliary to those means.

"Bleeding . . . should be employed only when deemed necessary by a medical practitioner. On the appearance of any symptom of returning life a teaspoon of sal-volatile or brandy should be got into the stomach and . . . repeated. The matter of heat being the stimulus . . . warm water heated to 100° F. may also be injected into stomach and rectum. If, after *vigorous* employment of these means for *two hours* . . . any brewhouse or warm bath can be obtained, the body . . . should remain in the bath or surrounded by warm grains or ashes for three or four hours.

"The apparatus for inflating and galvanizing the body invented by Dr. De Sanctis and the drag recommended by the Humane Society should be more generally kept at public or farmhouses, near to rivers and canals . . ."

The author then expresses his indebtedness to Dr. De Sanctis for the following remarks:—

"In every case of suspended animation, endeavour to restore the functions of the lungs and heart. To accomplish this, extend the patient's body either on the moveable back of the reanimation chair and fix it there with bandages, or on a convenient table. . . . The head and shoulders should be somewhat raised. . . . Introduce the *inflexible metallic tube*[1] into the stomach and fix it properly by means of the elastic regulator. *Pass the silver tube into the larynx*[1] and close the mouth perfectly with the coated plate and appendages. Close the nostrils with the forceps and the ears with cotton. Adjust the box bellows on the tube placed in the larynx and alternately force air into and withdraw it from the lungs; the latter operation may be effected by pressure on the chest and upper part of the

abdomen. While employed in these operations an assistant should be preparing the Pensile Galvanic Pile."

This galvanic pile consists of 100 metal plates $1\frac{1}{2}$ in. in diameter and $\frac{1}{16}$ in. in thickness which, when threaded on a glass rod, are dipped into diluted nitric acid. After drying, the strength of the pile is tested with the hands moistened with the acid solution. The plates, acid, stomach and laryngeal tubes, etc., can all be packed into one case for portability.

The instructions are then continued :—

"Having attached the galvanic pile to the top of the chair, one of the wires is to be applied to the tube passing down the gullet, whilst the other is to be successively made to touch different parts of the external surface of the body, particularly about the regions of the heart, the diaphragm and the stomach during the inflation of the lungs; then of the neck, describing the course of the par vagum or eighth pair of nerves (the old nomenclature) along the course of the spine, etc.

"Let the *globe*[1] filled with *ether*[1] or any other stimulating fluid that may be thought proper, be fixed to the tube in the gullet and be *warmed by means of the spirit lamp*[1] which may be lighted by the *ignitor* in the chest, which also contains lancets, ribands, etc. As soon as natural respiration is observed to take place, remove the coated plates, regulator, tubes, etc., but continue to apply galvanism and warmth aided by gentle frictions . . . until the pulse at the wrist shall have become . . . of sufficient strength. . . . The means recommended for the recovery of drowned people are equally applicable to a number of cases . . . such as convulsive fits . . . suffocation . . . strangling, intense cold, blows, falls, etc. Through their being neglected from the suspicion that the person is really dead, there is little doubt that the principles of life have been revived by the *heat and pure air* of the earth after interment."

To rid the lungs of any excess of water, he advises that "the body should be carried with the head lowermost so that, aided by the agitation caused by carriage, the gravitation of water from the lungs is permitted."

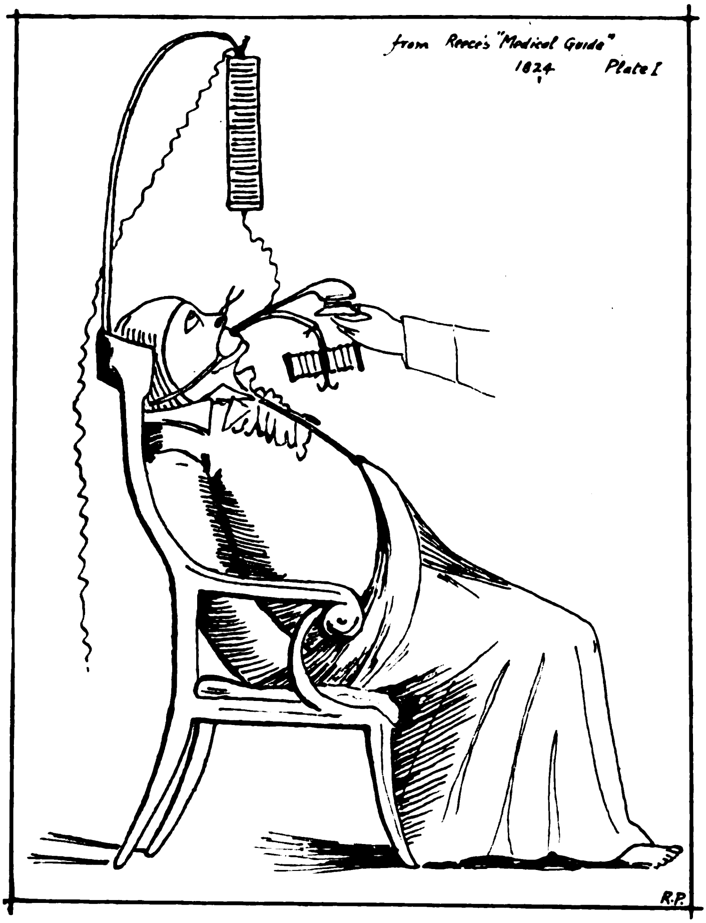
This position must not be maintained too long, it is said, for fear of causing congestion in the blood-vessels in the brain.

Regarding the pharmaceutical value of the enemata of tobacco smoke there must have been great controversy, for in Buchan's treatise dated 1805 [2] this remedy is recommended definitely, for therein will be found these paragraphs :—

"To stimulate the intestines, the fume of tobacco may be thrown up in the form of a clyster. There are various pieces of apparatus contrived for the purpose but where these cannot be obtained the business may be done by a common tobacco pipe. The bowl of the pipe must be filled with tobacco and after a small tube has been introduced into the fundament, the smoke may be forced up by blowing through a piece of paper full of holes wrapped round the mouth (bowl) of the pipe, or by blowing through an empty pipe, the mouth (bowl) of which is applied close to that of the other.

But, as it ought to be thrown well up, a pretty large syringe will answer the purpose better."

It was fully realized that warmth was an important factor in restoration, for Buchan [2] quotes Doctor Tissot, who reported an instance of a girl, apparently dead from drowning, who was restored to life by laying her naked body upon hot ashes, covering her with others equally hot, putting a



bonnet round her head and a stocking round her neck stuffed with ashes and heaping coverings over all.

After she had remained half-an-hour in this situation, her pulse returned, she recovered speech and cried out, "I freeze, I freeze." As a method of most unpleasant improvisation, the same Doctor Tissot reports an instance of a man who was restored to life after he had remained six hours under water, by the heat of a dung-hill. With this in mind it is not surprising to learn that sewn to the lining of the coat of a man who was liable to attacks of epilepsy followed by somnolence was a notice which read, "I

suffer from epilepsy—please leave me alone." I feel sure that this ingenuity must have been the outcome of bitter experience.

It will be seen that the *principles*[1] for restoration, i.e., warmth, artificial respiration and stimulation were the same as those carried out to-day, but the methods of applying those principles were of necessity more of an improvised nature and were undoubtedly more unpleasant to all concerned, for the reason that hot-water systems, rubber bottles, syringes, hypodermic tablets, electric batteries and such like were not invented.

The early beginnings also of a first-aid outfit are suggested and that such outfits should be placed in convenient situations where disasters from drowning are likely to occur is recommended.

Should any points be raised for criticism, they are firstly the difficulty and danger in unskilled hands of passing the inflexible metal tube into the larynx, and secondly, in view of recent accidents, there would be great hesitation in heating the bulb containing the ether with the open flame of the spirit lamp, the probable results of such a procedure being too horrible to contemplate.

The illustration, which is an enlarged copy, shows the forceps on the nose, the bulb attached to the stomach tube, the spirit lamp in the hands of an attendant, the box-bellows fitted to the laryngeal tube, the pensile galvanic pile suspended above the re-animation chair and the hands of the patient fixed by a bandage.

[1] Indicates that the italics are by Lieutenant-Colonel Priest.

REFERENCES.

[1] Fourteenth Edition, 107, *et. seq.*
[2] "Treatise on the Prevention and Cure of Diseases by Regimen and Simple Medicines," by William Buchan, M.D., F.R.C.P.Edin., Nineteenth Edition, 1805, 557, *et. seq.*

A CASE OF HYDROCELE TREATED BY INJECTION.

By Captain G. T. L. ARCHER,
Royal Army Medical Corps.

The injection treatment of hydrocele, although a method of long standing, fell into disrepute for some time, owing to the highly irritant nature of the drugs injected.

Thus we find in the eleventh (1924) edition of a "Manual of Surgery" (Rose and Carless) that "Injection of the cavity after tapping was for long a favourite method, but is now seldom employed. Many different reagents were used, such as port wine, tincture of iodine . . . perhaps the best is the tincture of iodine, but that contained in the B.P. is not strong enough"!! In the "Index of Treatment" (Hutchinson and Sherren), 1931 edition, we still find tincture of iodine mentioned, though carbolic acid with glycerine is recommended instead. It is also suggested that the

patient be confined to bed for one or two days. A trocar and cannula, in addition to a hypodermic needle, are used in the method described. No wonder the injection method fell into disrepute, leaving the field to operative treatment with its associated week in bed!

The perfection of the injection treatment of varicose veins, however, with the consequent introduction of sclerosing solutions of an ever-diminishing irritant action unaccompanied by loss of efficiency, has led to a revived interest in the injection treatment of hydrocele. Pybus [1] describes the use of quinine and urethane with excellent results, though at first he continued to use a cannula and local anæsthesia in his technique. Delisle Gray [2] describes the use of twenty-five per cent sodium chloride, acting for a short time (five to ten minutes), and used in such quantity as completely to distend the sac. His first case emphasizes the necessity for caution in the use of this method, and his later technique is rather elaborate. He further describes some successful cases treated by injections of Morestin's fluid (equal parts of carbolic acid, glycerine and alcohol).

I do not know the number of days in hospital per annum accounted for by the operative treatment of hydrocele in the Army, but I would suggest that by the use of these or similar methods the figure can be reduced to almost nil. One may expect the day when operation from hydrocele will become as rare as the excision of varicose veins.

The case I wish to quote in support of this contention is that of an officer who had had a small hydrocele for about four years. It had been tapped on three or four occasions; the last occasion upon which I tapped it prior to the injection treatment being early in November, 1931, when about seventy-five cubic centimetres of fluid were withdrawn through an ordinary large hypodermic needle.

As the filling up of the sac was becoming more rapid, and as the hydrocele was increasing in size, and since the officer did not wish to spend a week in bed if it could be avoided, I decided that on the next occasion it became a nuisance I would treat it by injection of quinine and urethane; since I did not share Delisle Gray's fear of quinine which, in his case, was the result of his decision (on anatomical grounds) to distend the sac completely with the fluid used. A preliminary series of graduated doses *per os* would demonstrate the presence or absence of such an idiosyncrasy as he feared might exist.

On March 12, 1932, therefore, I tapped the hydrocele by simply inserting a fairly large hypodermic needle into the most dependent part of the sac. One hundred cubic centimetres (approximately) of clear fluid were withdrawn, this being almost the complete contents of the sac. Two cubic centimetres of quinine and urethane (P. D. and Co.) were then injected very slowly, the patient experiencing only slight discomfort during the procedure; a little gentle massage was then used to distribute the solution all over the lining of the tunica vaginalis.

The result was similar to that described by Pybus. The patient, except

for about half an hour after injection and for a short time again the same night, when a slight but uncomfortable dragging pain, radiating towards the loin of the affected side, was experienced, suffered no inconvenience following the injection. For about a week the testicle was a little tender, but this tenderness was of such slight consequence that the patient was able to go out on horse-back on the day following the injection without undue discomfort or any ill-effect.

On the evening of the day after the injection a "crepitation" similar to that felt in a case of teno-synovitis was detected on gentle massage of the injected tunica.

On March 19, 1932, I again tapped the effusion (which had returned to some extent). The fluid was now cloudy, and contained a trace of blood; on standing, a thin clot formed at the bottom of the test-tube. The amount of fluid removed (as far as possible the complete contents) was thirty cubic centimetres.

Since that date there has been no return of fluid, and the hydrocele would appear, at the time of writing (six weeks after treatment), to be completely cured.

I was assisted in carrying out this treatment by Assistant Surgeon J. F. Freeman, I.M.D., to whom I am indebted for his help, rendered necessary by the fact that the patient was myself.

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[1] PYBUS, F. C. "The Injection Cure of Hydrocele," *Brit. Med. Journ.*, p. 239, February 8, 1930.

[2] GRAY, G. B. DELISLE. "The Injection Treatment of Hydrocele," *ibid.*, p. 649, April 5, 1930.

A FATAL PERISPLENIC ABSCESS COMPLICATED BY MALARIA.

BY MAJOR W. W. S. SHARPE,

AND

THE LATE LIEUTENANT E. G. C. DARKE

Royal Army Medical Corps.

THE following notes will, it is hoped, be of interest, on account of the difficulty of differential diagnosis. Private J., aged 28, had spent five years in India—in Calcutta, Nasirabad and for a short time in Ahmedabad, where he first contracted benign tertian malaria. There was no history of dysentery, and he stated that he had never suffered from diarrhœa, except very occasional slight attacks. His medical history sheet contains no relevant entries except those for malaria, viz.:—

Fresh infection in October, 1928, mild benign tertian, four days in hospital. First relapse (?) in September, 1930, eight days in hospital. A second relapse in June, 1931, the precursor of his fatal illness. The spleen

was much enlarged, three fingers' breadths below the costal margin and gametocytes were at once found in the blood.

The attack was mild, was not unusual in any way except for the splenic enlargement, and after three days fever, 101° to 102° F., and four days convalescence, during which he was treated with quinine hydrochloride with small increasing doses of liq. arsenicalis, he was discharged to barrack treatment. The spleen was then two fingers' breadths below the costal margin. The stools, which were a trifle loose, showed no cysts or ova.

Three days later, on July 2, the patient was "detained" in hospital, complaining of pain in the left side of the abdomen. The temperature was 100·5° F.; pulse 100. There was obvious fulness in the left flank. From under the left costal margin, extending downwards into the flank and backwards into the loin, was an elongated tumour with a sharp inner edge reaching a point midway between the umbilicus and the anterior superior spine and with its apex just below the level of the umbilicus. The tumour was tender and moved with respiration. The abdominal respiratory movement was normal and there was no rigidity. There were no physical signs in the chest. Blood-films showed no parasites. The condition suggested thrombosis of the splenic vessels. He was unfit to be sent fourteen miles for X-ray examination.

The following morning, July 3, the temperature had fallen to 99·4° F.; pulse 88. The patient felt "quite well in himself" and his condition was unchanged. Examination of the urine showed that quinine was not being absorbed. The urine was normal. The crenated edge of the spleen was distinctly felt, and there was no sign of rigidity. Evening temperature 102° F.; pulse 100.

On July 4 pain had subsided; temperature was 100° to 101° F., pulse 76 to 84. The condition was unchanged. Blood-films were repeatedly negative. Blood was taken for culture and agglutination, and the counts were as follows: White blood-cells 12,000, polymorphs 75 per cent, red blood-cells 2,800,000, small lymphocytes 20 per cent.

On July 5 the condition seemed definitely improved. He did not complain of abdominal pain; temperature and pulse remained the same. Quinine was present in the urine and no parasites were found in the the blood. Russo's test was negative. Agglutination (TAB) gave T 71, A 116, B 126, standard agglutinin units. He was last inoculated in December, 1930, $\frac{\text{TAB}}{2}$.

The patient's condition did not change until 3 a.m. on July 7, 1931, when he complained of a return of the pain and feeling of weakness; a "rub" was heard above the spleen and there was some cyanosis. This was followed by more marked cyanosis, acute abdominal pain, with tenderness and general rigidity, working of the alæ nasi and facies Hippocratica. The patient's condition was critical, and it was decided to give a blood transfusion in the hope that sufficient improvement would

take place to permit of laparotomy. No group sera being available, his serum was tested for agglutination against the blood of several donors, and one was selected. A pint of blood was obtained and transfused on the table by the citrate method with an improvised apparatus. Calcium chloride was also administered, but his condition did not improve and laparotomy could not be proceeded with. Death occurred two hours later.

Post-Mortem Examination.

The body was well nourished.

Abdomen.—The peritoneal cavity contained turbid, free fluid and a small amount of gas. The intestines were very injected and somewhat dilated. In the left hypochondrium was a large mass which extended forward to the mid-line and downward to the iliac crest. This proved to be a large peritoneal abscess containing foul-smelling pus and bounded *above* by the *left* portion of the transverse meso-colon, *anteriorly* by an enlarged spleen and by matted, indurated and œdematous omentum, to the *left* by the splenic flexure and upper part of the descending colon, to the *right and below* by coils of dilated, adherent small intestine and *posteriorly* by the peritoneum of the posterior abdominal wall. These structures were separated and revealed an indurated mass three inches long on the descending colon extending downwards from the splenic flexure. The intestine was opened at this point and the lumen admitted the little finger only. The transverse colon above the tumour was slightly dilated and the descending colon below somewhat collapsed.

The descending colon on being opened revealed, two inches below the splenic flexure, a large ulcer 1½ inches wide completely encircling the gut. The edges were slightly raised and everted but not indurated. The base of the ulcer was rough and necrotic and, at the right side of the colon in two places, extended deeply into the colon wall and thickened surrounding tissues. One of these deep excavations communicated by a small opening with the abscess cavity. The whole wall of the colon at this point was thickened. No other ulcers were found throughout the large or small intestine.

The spleen (weight 15 ounces) was enlarged, congested and indurated, and a part of the capsule was involved in the wall of the abscess and covered with lymph. A smear from the spleen pulp revealed no malaria parasites. The kidneys (weight 5 ounces) were normal.

The liver (weight 64 ounces) was normal and did not reveal the fatty change expected. The gall-bladder was normal.

The stomach contained much bile-stained fluid and the mucous membrane was healthy.

The pelvic organs were healthy. The heart and lungs were palpated by opening the diaphragm. The lungs were congested but no pleural adhesions or patches of pneumonia were present. The heart appeared

normal on palpation. No organism was found in the pus from the abscess cavity.

The descending colon was preserved and examined microscopically by Major L. Dunbar, D.A.D.P., Mhow District, who reported : "I have examined many sections of the wall of this abscess and, though I am of opinion that it was originally due to amœbiasis of the intestine, I have failed to find microscopic evidence of *Entamœba histolytica* infestation."

The sharp edge of the spleen anterior to the abscess and its apparent increase in size after the patient's discharge for malaria gave rise to an initial diagnosis of splenic thrombosis.

Echoes of the Past.

THE REMINISCENCES OF AN ARMY SURGEON.

BY LIEUTENANT-COLONEL W. A. MORRIS.
Royal Army Medical Corps (Ret.).

(*Continued from Vol. lviii, page* 149).

[IN the last section of Colonel Morris's Reminiscences which we published he described his journey home in the "Syria." Later Colonel Morris again proceeded to India. In the following section the author resumes his story when he is again about to leave India.—ED.]

I handed over charge of the hospitals at Murree at the end of October, and took leave pending embarkation, and proceeded to Lahore. I had served in the Pindi Division for fourteen years and left it with genuine regret. It is the finest station in India, and I had the fortune to serve some of the best officers of my Corps there—Sir T. Mansel, Sir C. Cuffe, Colonel Blennerhassett, and S.M.Os. like Colonels Pollock, Ring and Bourke.

We sailed home in the "Plassey," and arrived in London in the middle of a very cold snap, when I received orders appointing me to the charge at Edinburgh and S.M.O. Scottish Defences. It was a good charge which I was glad to get, but I rather wished it had been nearer my home in Wales. I began to think of the future, for I was an interminable time a Lieutenant-Colonel, and as a matter of fact became 55 years of age before my turn came, but I was on the selected list for promotion. I had been ten years a Lieutenant-Colonel, a rank the majority pass through in three to five years. This was due to three very heavy batches which entered the Army before me and blocked promotion.

I knew Edinburgh well, the good-natured Scotsmen were always very kind to me, and I had many friends among them. We took a house near the Pentlands, where I used to play golf and also at Morton Hall and Barnton.

Colonel T. Corker was the Principal Medical Officer, and was liked. Mrs. Corker and he were most kind and hospitable, and he kept up the traditions of the Corps handsomely; most of our Colonels never failed in their obligations in this respect.

The charge was an interesting one, and I had a lot of work to do. I recollect going round the wards and noticed some rather worn blankets. However, I was assured they were quite serviceable, and did not interfere, but they still attracted my attention. At last, I saw one with a hole in it, and having a chance to establish my opinion, I wreaked my wrath on it by enlarging the hole considerably with my stick, proving easily its worn and rotten state.

I overhauled these blankets and directed a few of them to be exchanged. The exchange passed all right, but the Barrack-master reported that one of the blankets appeared to him to have been "*maleeciously*" torn, and he desired a Board to establish the responsibility and fix the price. I wrote all the defence I could and explained that I only pointed my stick at the hole, and the perished blanket disintegrated. I was determined to fight this blanket business to the last ditch. At the time I noticed a very sympathetic orderly, and when I was alone in my office after the hospital work, he knocked at my door, and asked if he might communicate something to me about the blankets. Looking round to ensure that nobody heard him, he informed me that the date of the first issue of the blankets was 1854 or 1855. These blankets were fifty years old, and when I established that fact no further action was necessary. It is not usual to find such old equipment, but I remember in 1882 discovering in the hospital at Fort George an old-fashioned enema apparatus. It was a syringe, with a capacity of about two pints, and a nozzle of terrifying proportions; this fearful engine was another proof of the remarkable hardness of the Scotsman and his contempt of danger and pain. I lent it to the Mess as a curious old relic of the days of Bruce.

Mackessar, Ryan, Galbraith, were my medical officers, and right good fellows they were. I also had outlying posts at Glencorse, Jocks Lodge, and Leith, and visited these frequently. I do not know the reason, but I could not settle down, for the roving spirit was always strong in me. India was calling and calling, and I determined to try again. I went up to London and called on the Director-General, Sir Alfred Keogh, and asked if I might exchange. I do not believe that he altogether approved of it, thinking quite rightly that I had served too long in India, but with his usual kindness consented. I visited Mr. Prince, the exchange agent, and he promised to arrange an exchange. I knew Mr. Prince well, as most officers did. He was a businesslike little man and I always found him very fair and straightforward in the many dealings I had with him, and it was not long before he arranged an exchange for me with Colonel Grier, a well-known and distinguished officer in the Corps.

I returned to Edinburgh and began to prepare for another tour in India,

much delighted with the prospect. All my professional life was centred in that country and its people. I took a great interest in the ancient history and art of India, especially in Buddhism.

In October I embarked for the last time for India on board the Transport "Dongola," and disembarked at Karachi. We were a pleasant party on board and got on well. Major Inkson, V.C., son of Surgeon-General Inkson, and his wife, Major and Mrs. Lelean, and Major and Mrs. Withers formed the medical staff with one junior whose name I forget. Nothing of interest occurred on the voyage, and three weeks later we reached Kiamari, which is the port of Karachi. I reported to the G.O.C., and received orders of appointment to the Cawnpore Military Hospital. We reached Cawnpore three days later after a most trying journey across the Scinde Desert, and were very glad to arrive and rest. Rooms had been taken for us at the Empress Hotel, and thither we proceeded with our children and belongings.

Cawnpore is a dismal station to arrive at, but improves very much on acquaintance. At this time the Superintendent of the station was an old soldier named Ryan, who from small beginnings, and by good conscientious work, had raised himself to his high position. He was an Irishman of the best type, full of fun and humour, and could tell some very amusing stories. He told me one which was up and against the railway: On one occasion a traveller arrived at a junction, in the middle of an extensive and wild jungle. Here, the traveller had to change and wait for the next train, and he seemed pleased at the prospect of a rest. He stretched himself, and shot his legs out alternately to make sure that the hip-joints were working freely. His train passed out, and he watched it tailing away into the distance. He then approached the Booking Office and asked when the next train to take him on, would arrive, and was informed, "In nine hours." Owing to the careful arrangements of the Company, the mail only caught the earlier train when this could not start, or the goats of the stationmaster's wife had strolled up the line, and she would not let it start. Could he get breakfast? No, there were no arrangements.

The traveller made the best of it, and in the evening he noticed the presence of a cemetery close to the station, and as it was the only evidence of life, and that previous life, his curiosity was roused. The stationmaster had done his best to help the weary waiting passenger, and when asked why there was a cemetery there, said that it was full of Europeans who had died of heat stroke and consumption waiting for trains at the junction and had been buried there.

There was a Eurasian I had known many years, a dealer in horses, and an expert judge. When he was younger he was a first-rate rider. He attached himself to me all the time I was at Cawnpore, and very useful and honest I found him. This was Mr. Charles Braga. Many officers of the older type will recollect him riding a race for a wager with his face towards the tail of his mount, and winning. Braga performed many kind actions,

and helped me very much with my stable. I have received one or two letters from him but none lately, so I expect he has passed on to the happy hunting grounds—and once more will be in his element.

The Empress Hotel was the principal rest house of the Cantonment, and was well managed by an enterprising Frenchman and chef, and as I could not at once get a house in the Cantonment it was a great convenience.

Cawnpore comprises a large civil station, in which many merchant princes live, as well as the British cantonment. Both the civil and military divisions are on the bank of the river, while the city debouches in the direction of the Kalpi Road. It is a popular station and fairly healthy, but there is always a gloom present, reminiscent of 1857—the Memorial Well in its beautiful garden ever reminding the residents of the deadly and vindictive Nana of Bithur who wreaked his vengeance on 120 poor women and children in the Massacre House.

Major-General J. C. Keir (now Sir John Keir, K.C.B.) commanded from Allahabad, and the Principal Medical Officer was Colonel Louis Anderson, C.B. (now Surgeon General). Anderson had a great record of service, including the seige of Mafeking. No one grudged him his early promotion for it was given for gallant service. I frequently went to Allahabad and stayed with him, and most delightful visits they were. Later Mrs. Anderson and her daughter came out, and I found Mrs. Anderson as charming as her husband.

Cawnpore was in an unhealthy state when I took it over, possessing an evil reputation for enteric fever and dysentery. I changed the whole system of conservancy to a combined perchloride of mercury (1 in 2,000) disinfection with incineration, and a few remarks on the work at that time will possess some interest to many older officers.

The secret was that I did not use an acid solution of perchloride disinfectant as directed by the Regulations, and consequently retained the albuminate of mercury in my mixture, which in its turn formed an albuminous envelope round all matters mixing with it. In this way I arrested odour, and imprisoned the bacilli of enteric, dysentery, etc., and was able to prove that they died or became innocuous long before the albuminate disappeared.

I abolished the lids of the receptacles behind the latrines as they were not wanted. The advantage of a perchloride installation is its destructive effect on flies and bacteria. It is a deadly poison in its crude state, but in a solution of 1 in 2,000 it is less poisonous, and so unpleasant that it would be difficult to drink accidentally a poisonous dose.

The Gordon Highlanders, a Battery R.F.A., an Indian Cavalry Regiment and two battalions of Indian Infantry, were stationed at Cawnpore. Besides these the Government Harness and Saddle Factory came under the C.O.

We possessed a Scotch nurse, who was very popular with the Gordon Highlanders. One day the nurse with my daughters were present at the

Gymkhana races, and the two girls backed "Grey Fox" which belonged to Major Macnab of the Gordons. This nurse had heard Macnab tell my girls not to back his horse, as he did not want them to lose or win on his entry; the nurse made up her mind that "Grey Fox" had no chance, so backed an outsider, but the children backed him, and my youngsters raked in a good stake, and the nurse lost. These races were very charming events and at Christmas we not infrequently had our old friend Captain Butler (now Lieutenant-Colonel) staying with us. He is a very good old friend indeed, and comes and sees us in our country retreat, and his visits are very welcome and a delight to us.

One day a son of Sir Cecil Beadon called, and asked us to visit him at a place on the River Jumna called Hamirpur. Beadon was an officer in the Police, well informed, and with a very inventive mind, who lived by himself in a large bungalow on the bank of the river. We travelled to Hamirpur by camel-carriage, a long tedious journey, ending in a crossing over the river in a waste of sand. Beadon was there and gave us a kind welcome. At this time he was full of the science of flight, and had constructed a remarkable kite. He took us to the edge of a cliff, and threw some models out towards the river, but instead of flying, they nosed dived at once, and were damaged. He was more successful with a large kite attached to a windlass, placed in the bed of the river, where the breeze was very strong and lifted the kite as high as it could go, with a basket carrying a cat. Beadon was experimenting quite scientifically, and under more favourable conditions, would have made a fortune.

Hamirpur had been an important place, and during the Mutiny many were killed there. It lies on the edge of the Bhurtpore territory, and is controlled by an Assistant Magistrate. Dacoity was frequent, and Beadon kept three fast camels always at hand to take him quickly to the scene of robbery. He rode one himself, the second carried his cook, bearer, and kitchen, and the third an orderly and tent. He could run twenty miles in a little under two hours.

Another place near Cawnpore was Najafgarh, where we camped frequently. This place is situated on the bank of the Ganges about ten miles down stream, and in the earliest history of India was an important place, but its greatness has passed, though some signs of ancient glory still remain. There was a fine mosque, and also some large temples, but the marked feature was some old processional arches, standing up on old roads and surrounded by overgrowth and jungle plants. These arches were designed on very artistic principles and elegantly decorated. The height from the ground to the soffit of the arch was between fifteen to twenty feet, thus allowing space for the tallest elephant with a state howdah to pass beneath. Close to the large arch on the main road I met a man who was about seventy years old (1909), but still active. He had been an officer's servant for many years, and pointed out a place by the side of the road, where when he was fifteen years old he saw the Highlanders rest on their

march to the relief of Cawnpore. He also heard of the fight between the English in the boat, under Major Vibart, which escaped down stream from the ghat at Cawnpore, and ran on a sand-bank. Another boat carrying some of the enemy attacked them, and though famished, exhausted and weary, Vibart's crew turned on them and drove them off. This sand-bank was in front of Najafgarh. There is a bungalow which is now more or less a ruin, also on the bank. At the time of the Mutiny it was occupied by a planter whose name was Taylor. He was attacked by overwhelming numbers, and lost all his family. He fought like a fiend and killed many before he was struck down. I tried to realize the story by standing in the doorway in which he made his last stand, as marked on the plinth of the house, and could easily understand Mr. Taylor's remarkable bravery as well as his hopeless position when surrounded by large numbers. His valour is remembered and talked about to this day.

Najafgarh stands in the centre of a fibre plantation, which at the time of my visits was managed by an ex-roughrider of the Royal Artillery, named Lansbury, and I believe a connection of the socialist of that name. However, Lansbury at Najafgarh preserved the traditions of his country and the Royal Regiment, was loyal "to a hair," and allowed nothing to turn him from his duty. He was very civil and helpful to me, and I liked him. He told me that an assistant came there once, who, in his own estimation, could ride anything, and as Lansbury thought he might supplant him, he mounted him on a horse which became troublesome, and managed to get among the fibre plants. These stand at equal distances and are three to four feet high, well furnished with spikes. The horse to escape being pricked made short high jumps, or bucks over the plants, and soon threw his rider. The ruse was successful, and Lansbury remained. I hope he has made a success of his charge, but I have never heard of him since I was last at Najafgarh.

The large civil community was led by some merchant princes like McRobert, the Allen brothers, Ledgard, and we frequently dined out with them. Major Young was the Civil Surgeon, and Doctor Fuller held charge of the Mills. Fuller was also a Major Medico of the Cawnpore Light Horse, and a most charming and pleasant fellow. I hear that he is still working at Cawnpore.

The correct spelling of Cawnpore is Khanpur, the City of the Khan, but the familiar spelling has never died from this city of gloom. It mattered not which way one turned, there would be some evidence of the terror of 1857. I took a considerable interest in the Mutiny at Cawnpore, and read every narrative and book I could obtain. I then rehearsed the conditions as nearly as I could, by visiting the various places and realized the heat, the wet, the hopelessness of gentlewomen with innocent children, cut off from their husbands, or being shot and knifed to death with them on the plain. Consequently it was a great relief when the leave season commenced; our first leave was taken at Simla, and we settled down at the Gables Hotel at Mushobra.

The next day I reported at the Headquarters Office, and once more met my old friend Lieutenant-Colonel R. S. F. Henderson, Staff Officer to Surgeon-General Sir Francis Trevor, K.C.S.I., the P.M.O.India. Henderson was just the same delightful, loyal friend. He did not know it, but I found him to be the most popular man in Simla, with an intense sympathy for young fellows, and for poor people who wanted help. He was known as "God's Good Man," and that expressed in three words far more than I can write about this splendid man. He told me that Sir Francis was at his home with a bad cold, and that he would be pleased if I paid him a visit.[1] I rode at once up to Jackoo and called.

Sir Francis received me, and as we had known one another many years before we had much to talk about and pass the time. He had a fine record of service, and was quite the very best type of a British officer. He was a chief who encouraged his officers to work, and had the courage to act.

My two months leave passed very quickly, during which we often had tea at The Chalet with Henderson, who attached himself to my two little daughters and with other young friends of his gave them delightful teas, and sent them home with beautiful presents.

A day or two before my leave expired I paid Sir Francis a visit to wish him good-bye. He asked me if I knew anything about the Indian Medical Service, and if I had formed any ideas as to how it might be improved. I said all I possibly could, and he then called Henderson and put me on as Vice-President of a Committee to consider a reorganization of the Indian Medical Service, and this kept me up at Simla for the rest of the hot weather. Sir Pardy Lukis, the Director-General of the Indian Medical Service, was President of this Committee. I had known Lukis all my service as a charming personality, and one of the most able and clever members of his Service.

Lukis and I met and framed a scheme, and then turned the three junior members into a sub-committee to work out the detail. We brought out an efficient organization, which was turned down by the Financial Department, and no one regretted this more than the Government of India when the Indian Medical Service, through no inherent fault of its personnel, broke down hopelessly in Mesopotamia.

The following year, and my last in India, I spent in Kashmir. The beauty of the scenery and the idyllic life appealed to me very strongly. Every moment seemed to be crowded with interest. We travelled by tonga from Rawalpindi in April and reached Murree the first day. The next morning my wife started in one tonga, and I followed in another with

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[1] I am reminded of Lowell's lines, which seem peculiarly appropriate to Henderson:—

"No beggar ever felt him condescend,
No prince presume; for still himself he bore
At manhood's simple level, and where'er
He met a stranger, there he left a friend."

my younger daughter and a cook. I noticed at once that our ponies were a pair of weak rats, very much out of condition. We started down the road, which was bounded on the outside by large stones. The animal next to the stones jibbed at once, and this drove our tonga on to the side and arrested our progress, with a jerk against a large stone. The jibber rolled over the khud and was held by a rein, or it would have fallen far; the other fell on the road. From my seat beside of the driver I saw the dangerous position we were in, and I jumped from the carriage and fell on my cook in the road. There was, however, no time to be lost if we were to save the pony. We took the cushions from the tonga and placed them to give a foothold to the pony, which luckily got up very quietly, and the driver led him by a diagonal route to the road. It is a marvel to me how that animal escaped, but it evidently realized its dangerous position. The other pony was raised up, and as the tonga was swung into the road, the large stone which alone supported it rolled over. It was a narrow escape.

However, this was a mere bagatelle to our intrepid driver, and he soon put the animal under the curricle bar, and we careered down the rest of the hill as though nothing had happened. The first change took place below Topa, at the commencement of the long descent from 5,000 feet to about 2,181 feet at Kohala, where we should enter the Kashmir territory. The distance is about twenty miles. All went merrily as a marriage bell, when suddenly we were scraping along the ground, and the tonga again came to rest. Looking through the vehicle, I saw that the surcingle (belly-band) of one of the horses had broken, but luckily nothing worse had happened, for we were running down a road with a huge precipice on one side. The damage was quickly repaired, and we reached Kohala without any further trouble, crossed the bridge, and went on to Dulai, the first stage in Kashmir. Here there is a very good rest house, and a favourite one for newly married folk to go to; it bears the agreeable name of the Honeymoon Bungalow. It is very prettily situated on a high bank above the river Jhelum, which races in a torrent over its rocky bed to the plains. There was a very civil man in charge of the rest home, who gave us a good lunch, and we all went to sleep. Later we obtained good baths, and had tea, and wandered about the compound till dinner time, and then slept till 5 a.m. Dressing and breakfast did not take long, and soon after 6 a.m. we were galloping in the fresh air to the next stage. However, we were not going to have it smooth all the way, for suddenly I came on my wife's tonga halted in the road, and the horses taken out. One animal was held by two men, with one of its legs tied up to prevent it doing damage. It was a savage brute, which the coachman told me had never been tried. I insisted on the animal being exchanged, and we were delayed.

After a short time away we went, passing Domel. Here the scenery became very wild; the most striking feature was the immense quantity of olive trees in blossom, which gave a most beautiful effect. A run of some miles brought us to Garhi Rest House. This was a large and

comfortable rest house with much more space round it than we had at Dulai.

The next day we ran from Garhi to Uri (forty-eight miles), a short run, and found ourselves in an exceedingly nice rest house, in a lovely spot surrounded by mountains. The Khansama arranged a *table d'hôte* dinner, at which we met some fellow travellers. We spent the evening watching the sunlight pass off the mountains, to be succeeded by the dark, for there was no moon, but only the starlight which was just sufficient to show some snow on the peaks standing like sentinels around us, and giving a superb effect.

We were up and off by 7 a.m., and after running for two hours, we halted by a waterfall and enjoyed our breakfast in the open. We were well in Kashmir now, and commencing our leave in real earnest. Starting off again, we drove along a cruel precipice, and at one place halted where the road had given way, and the earth was actually moving and silting over a precipice down to the river. We were told to get out, and the coachman took a run through the silting earth, with the wheels sticking deeper and deeper, and the draught exceedingly heavy. He lashed his animals as he stood up like an old Roman charioteer, and emerged safely with a smile. We then walked across. This is a well-known danger, and more than one tonga with ponies and driver has fallen into the river.

(*To be continued.*)

Travel.

THE RIVIERA BY ROAD.

BY CAPTAIN W. L. SPENCER COX, M.C.,
Royal Army Medical Corps.

As the summer of 1931 was wet and cold generally, and in South Wales was even worse, we decided to go south; to leave the dull, depressing days which seemed so endless; to revisit old haunts and to explore new ones. After all, the pound was still worth 123 francs, and the car, a Morris Oxford Six, had four new tyres; so, with a promise of hot sun and good bathing, we decided to set off on the long trek.

Embarkation at Newhaven was easy; we stopped at the A.A. Port Office to see that our papers were in order, and after superintending the emptying of the petrol tank, left the car, complete with baggage and rugs, on the quayside to be loaded on the S.R. cargo boat. The passenger boat was to leave an hour later, so there was time to dine in comfort and get on board before the crowds from the boat train arrived.

It was bitterly cold and raining, and out in the Channel a gale was blowing. We left the "Sunny South Coast" without regret; the crossing, however, was not pleasant.

On arrival at Dieppe at 2 a.m. there was considerable excitement as the majority left for the Paris boat train, and much tipping of stewards by those who had spent the night "bowl in hand."

For us there was another six hours of peace and sleep, and we made the most of it. At 8 a.m. we breakfasted on board and climbed on to the quay; a wet mist hung over the docks, and the row of cars already unloaded looked cold and desolate.

The first necessity was petrol, and, as no pumps are permitted on the quayside, a dilapidated Ford van soon appeared loaded up with five-litre bidons. We took in eleven of these and started to warm up the engine.

The Douanier and the A.A. Port Officer were now going over each car in turn, checking up the entries on the carnet and examining the International Driving Passes and Car Certificates.

The A.A. supply two small plates engraved with the owner's name and address and the engine and chassis number of the car; these are screwed inside the dash-board, and afford a quick reference. We were told that in our case it would be cheaper to take out a quarter's tax, rather than to buy a *laissez-passer* for forty days, but in order to leave the docks it would be necessary to have a *laissez-passer* for one day. The Douanier then demanded, rather timidly I thought, whether we had anything to declare; "Of course they haven't," said the A.A. man, and that was that!

We were now free to leave, and made our way to the office of the Contributions Indirectes in the town, where a quarter's tax was paid, and finally at 9·30 we left in earnest for Rouen.

The road is described as "a wind-swept agricultural plain, with little variation of scenery," but, as we apparently took the wrong road to start with, we *did* find some variation of scenery and a good deal of mud as well.

At Rouen there is a good deal of twisting and turning, and at least a dozen obliging people told us the best way through, in spite of which we found it without difficulty.

The road now improved, the sun was shining and lunch time found us at Gaillon.

After Vernon, Mantes and St. Germain, the road follows the valley of the Seine, passes through Versailles, then skirting Paris, we turned to the right into N.7, which is rather narrow and crowded at this point, and it was here that our journey nearly ended abruptly. A stream of heavy traffic was trundling slowly out of Paris, and the fast cars coming in refused to give way at all as we manœuvred slowly round camions and trailers. H. was driving at the time and, through no fault of her own, was being gradually forced towards the left of the road. A heavy lorry was approaching slowly, and it seemed that by a legitimate cut-in we could regain our own side, but on starting to do this a Sports Bugatti, hidden behind the

lorry, also made a rush for the gap. There was only one thing to do, and she did it, shooting the Morris straight across the front of the oncoming lorry, we landed high and dry in safety on the pavement on the wrong side of the road. The scattered pedestrians cursed heartily, but being so close to Paris they were probably accustomed to this sort of thing; a moment later the traffic cleared somewhat and we were able to regain our normal position before the arrival of the law.

We progressed rather sedately to Fontainebleau. The forest here is certainly magnificent, and the wide, straight road cut through the trees in no way detracts from its beauty or mars the setting.

We were now on N.5 *bis*, and the forty odd miles to Joigny were covered both in speed and comfort. I had wanted to make Avallon for the night, but the bad roads in the north and the congestion round Paris had

FIG. 1.—Nantua.

somewhat delayed us, and on arrival at Auxerre, after a run of 238 miles, we decided to go no further. Perhaps it was as well, for the town was crowded, and it was another half-hour before we could find beds at an unassuming, though comfortable, auberge.

We were away before nine the next morning and travelling along that magnificent road N.6. From the point of view of the motorist who is using his car purely as transport, it is one of the finest I have driven on. It has an excellent surface, though a trifle narrow, but is clean and straight, through mile after mile of open country, where one can average forty miles to the hour without exceeding a speed of fifty miles an hour.

Saulieu followed Avallon, and we pulled up for lunch at Challon-sur-Soane. On reaching Tournus we joined N.75, which took us through Bourg and at Pont d'Ain on to N.84. At Poncin the climb over the Jura foot-hills commences. This is a good winding road through miles of vine-yards, and finally we came to Nantua, nestling in the mountains behind a

miniature emerald-green lake. From here on to the Franco-Swiss frontier at St. Julien-en-Genevois we had an occasional glimpse of snow-clad peaks on either hand.

The frontier was crowded with cars, but an obliging R.A.C. scout marshalled us through the Customs and we were in Geneva by cocktail time, after a run of 243 miles.

The next morning was cloudy and the famous view of Mont Blanc from the bridge of that name could not be had, but even the dullness of the day could not damp our appreciation of the splendid bridges and wide boulevards of that fine clean city.

On pausing now and then to watch the traffic, one was impressed by the number of cars of different nationalities, judging, by their plates ; G.Bs. followed A's and B's, R.M.S's and S.H.S's and even G.B's covering the rare Q.Q. or Q.D.C. letters of foreign cars imported via Britain.

FIG. 2.—Pont de Mont Blanc, Geneva.

We left at midday and, passing the frontier again, made our way to Annecy and Aix-les-Bains, following the valley of the Isère to Grenoble, the old capital of Dauphiny, and one of the most beautifully situated towns in France.

It was still early and we decided to push on as far as we could through the magnificent Chartreuse mountains towards Sisteron, but at this point a heavy storm broke and for half an hour we toiled through torrential rain on a somewhat dangerous road. It cleared, however, before dark and I was able to get a photograph in the twilight.

The road now led over four cols, the highest of which was 4,000 feet, and then began to descend into wild grey country reminiscent of the hills of North Coimbatore. We stopped for the night at Aspres-sur-Beuch, a small village in the mountains, and found we had chosen badly. However, it was too dark to go further and the 168 miles of mountain road

had been rather tiring, so we had to make the best of it. The only hotel was primitive and full of flies, and in spite of running water and electricity the sanitation was of "Indian pattern."

It was clear and bright the next morning and, after filling up the car, we got away early.

I might digress here to say that we found the supply of petrol and oil throughout the country to be excellent; no village was too small for a pump of "Standard" or "Shell," while "Vacuum," "Castrol" and "Shell" oils were available in sealed 2-litre bidons. The cost, however, varied considerably, in the case of petrol between 7·50 and 12 francs per 5 litres (approximately 1 gallon), while oil was round about 22 francs a bidon, in each case a good deal in advance of the prices then obtaining in England.

The road now ran through the Dauphiny Alps to Sisteron, a most picturesque old Provençal town perched in a rocky gorge with bleak crags

FIG. 3.—Chartreuse Mountains.

rising above it, then Digne, where we commenced to climb again to the defile of the Clue des Chabieres, and still higher by a narrow pass over the Col des Leques and finally down again to Castellanne. This is another rather bleak Provençal town, and the scenery remains wild and arid with three more cols to cross before the winding descent into Grasse with its flowers and perfume factories. From here the whole panorama of the Mediterranean gradually unfolds itself and the vegetation becomes more and more tropical.

Just beyond Grasse we had our first trouble—two punctures at the same time in the near wheels, so that what with the heat and the fact that we only had one spare, the situation was somewhat tense! However, the damage was repaired at Cagnes and we completed our last lap through La Californie and over five kilometres of the Promenade des Anglais, arriving at Nice after a run of 157 miles.

The summer months are generally quiet on the Côte d'Azur; Nice, Cannes and Mentone are more or less closed and therefore extremely pleasant, while that fashionable resort Juan-les-Pins, and to a lesser extent Monte Carlo, run a summer season.

The Italian side is also very attractive and we got a great deal of amusement at San Remo watching our Italian *confrères* strolling on the plage in full uniform, their swords trailing in the sand. At the Franco-Italian frontier, too, there was always the little passport comedy; we could speak no Italian, "Was M. le Capitaine actif?" "Yes very"! Then followed a conference in an inner room and finally one was rather grudgingly allowed to proceed, their hesitation no doubt being due to the fact that the frontier is said to be heavily fortified at this point.

Nice made a good headquarters for the district; glorious weeks of sun

Fig. 4.—Monte Carlo.

and sea bathing soon made one fit again; England, rain and rheumatism became things of the past. In addition to the usual amusements of the place we drove a good deal, exploring the whole coast line and the mountains behind, and that brings me to the great Corniche roads of the Côte d'Azur, of which some account should be given. There are four in all, three running east from Nice towards Monte Carlo and Mentone, and one going west from Cannes to St. Raphael. The three former are: the Grande, the Moyenne, and the Corniche du Littoral respectively, and run more or less parallel.

The Grande, which corresponds to the old Via Aurelia of Roman days, is the oldest and rising to a height of 2,000 feet in the Maritime Alps was the Legionaries, main road to Gaul. To-day it is a fine, well-engineered road which carries the motorist eastwards above Monaco and drops him down through Roquebrune into Mentone and Italy.

The Corniche du Littoral skirts the coast and is the main highway from Nice to Villefranche—Cap Ferrat and Beaulieu.

The Moyenne, which took years to build, is the newest and finest; cut out of the rock half-way up the mountain side, it commands the most perfect views of sea, forest and mountain, and with its fine surface and wide bends is a joy to drive on. At night, with a blazing moon above and the sapphire sea below, the scene is one that can never be forgotten.

The western road, the Corniche d'Or or de l'Esterel, is very different. It was built as the result of the combined enterprise of the P.L.M. Railway and that powerful and energetic body the Touring Club de France, and for sheer beauty is without comparison on that coast. The sea is deep blue and perfectly clear below; the rocky edge of the Esterel is almost red behind, and the road winds round headland after headland, with the most

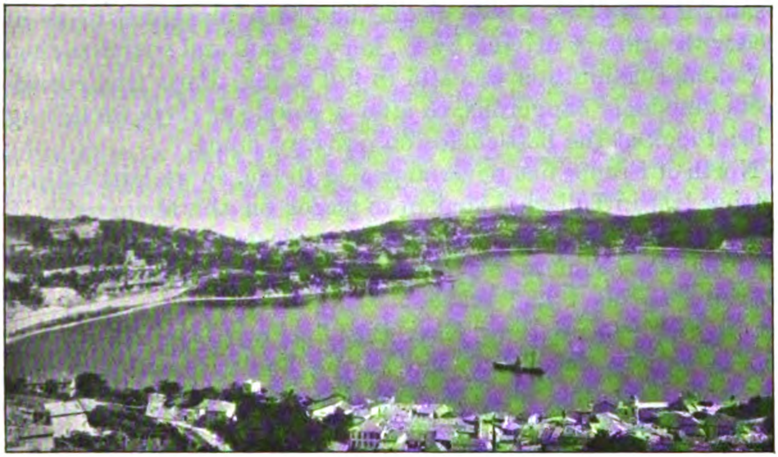

Fig. 5.—Cap Ferrat.

perilous curves and hairpin bends, through the pine forests, and so to Anthéor, Agay and St. Raphael. It is dangerous driving, however, and if you wish to enjoy the endless panorama of sea and mountain, put someone else at the wheel. You cannot drive and look at the view.

As all good things must come to an end, one blazing morning we had to leave. The sea was an oily swell along the Promenade des Anglais, Juan-les-Pins was shimmering under the haze, and Cannes was just coming out to bathe and play medicine ball on the sands.

We drove over the massif of the Esterel, this time by the inland road, and again had that feeling one was crossing the Ooty Downs or about to enter Kotagiri.

We lunched at Aix-en-Provence and pushed on at once to Lyons; here we were on N.7, probably the best known road to motorists in the whole of France. We only paused for a moment at Montelimar to buy nougat,

but on arrival at Lyons we decided to go through and put up for the night at Villefranche (Rhone), some few miles further on. But how to get out of the town? Lyons appears to consist chiefly of rivers and bridges, of which there are endless numbers, and our route directed us to leave by the Pont Kitchener. Unfortunately, I had never learnt to pronounce the great soldier's name in French—*Keetchener*, *Kitchéner* and *Kitchenère*, we tried, all without success and finally, after crossing in turn all the bridges in Lyons, an intelligent native put us on the right road, and Villefranche was reached after a run of 333 miles, during which the Morris, laden as she was, had excelled herself.

Lyons to Paris was a pleasant but uneventful run of 293 miles, uneventful at least, except for the last few kilometres from the Port d'Italie to our hotel, during which we experienced in rapid succession every unpleasant sensation known to motorists. However St. Christophe, the patron saint of travellers, whose plaque had been presented to us at Nice, combined with brilliant driving by V., kept us safe and sound to the end.

The Colonial Exhibition was still in full swing, Paris was crowded and the streets unusually dangerous, so after a couple of days we left again to have a brief look at the battlefields on our way home.

The North of France has never appealed to me, so we hurried along and, after getting lost in Lille and shaken to pieces on the abominable Belgian pavé, arrived in Ypres after 182 rather unpleasant miles.

Here I found my camera was missing and with it, to my great annoyance, the last three spools I had taken.

That night we heard the "Last Post" blown from the Menin Gate. I had not been back since 1916, but as the bugles ceased and the lights went out, that old eerie feeling came back, and one conjured up visions of the horrors and joys of those days.

We had booked for ourselves and the car on the s.s. "Autocarrier," and the run from Ypres the next morning was only seventy-seven miles, though in the war it seemed a Sabbath day's journey.

The boat only takes cars and their occupants and is specially built for that purpose, the loading is extremely easy and the passenger accommodation excellent; there was no emptying of petrol tanks this time and no fuss on the quayside.

Our carnet, now getting somewhat thin, was stamped and a slip torn out for the last time. And so, after 3,000 miles of sheer delight and a total damage of two punctures and a bent track rod, we landed at Dover, where, the Customs being done with, the last word came from the A.A. Port Officer ". . . and don't forget to keep to your *left*, sir"!

Current Literature.

Diasio, J. S. **A New Bactericide for Treating Anterior Gonorrhœa.** *The Military Surgeon*, U.S.A., 1932, 70, 595.

The author of this article as a result of the great number of rapid cures effected in cases of specific leukorrhœa in women by a new bactericide—oxyquinoline tartrate—was encouraged to test its efficiency in cases of anterior urethritis.

This compound, which was evolved after much experimentation and chemical testing, was found to kill *Staphylococcus aureus* in from a half to one second in as low a dilution as 1 in 4,000. The chemical is stated to be non-corrosive, non-irritant, non-poisonous, antiseptic, antifermentative, and not coagulating tissues. Its chemical formula is $C_6H_7N(OH)C_4H_6O_6$. The medicament is made in rod-shaped, effervescent tablets, about 0·6 by 0·3 cm., thus allowing easy introduction of the tablet into the urethral canal.

The following is the method of using the oxyquinoline tartrate, which was carried out in a series of seventy cases of anterior urethritis of specific origin:—

The penis is thoroughly cleansed with soap and water, after it has been determined that the patient has anterior gonorrhœa. A tablet of oxyquinoline tartrate is then introduced through the meatus and pushed inward by the point of a small steel probe into the fossa navicularis of the urethra. The meatus is then thoroughly sealed with adhesive. A large pledget of cotton is then tied about the glans penis and retained until the next voiding, when the plaster dressing is removed. The treatment is carried out every other day until the smear becomes free from gonococci; the watery discharge remaining is then dried up with a few irrigations of boric acid solution. The patient is kept in bed during the acute stage and should rest as much as possible during the subacute period. A milk diet with an abundance of water is prescribed. No other drink is given. The bowels should be kept open.

The chemical action of the bactericide is explained, and this, briefly, is that the tablet effervesces when melted by the body heat and the foam carries the oxyquinoline tartrate deep between the lining epithelial cells of the entire anterior urethra, into the lacunæ and crypts of Morgagni and urethral glands, destroying the gonococci in its wake.

Successful cures are stated to have been obtained in over ninety per cent of the seventy cases dealt with, and the length of treatment ranged from two to three weeks. The cured cases have been observed for periods

of from four weeks to nine months without recurrences or relapses. In the remaining cases these were found to be posterior urethritis and treatment was prolonged.

The oxyquinoline tartrate is well tolerated and causes neither pain nor discomfort.

In a note Lieutenant Diasio states that the drug is not yet manufactured for sale.

MAJOR YAMAKAWA. **Experimental Studies of the Properties of Extravasated Blood in the Subcutaneous Tissues and in the Peritoneal Cavity, with Particular Regard to the Surgical Significance Thereof.** *Journal of the Imperial Japanese Army Medical Corps*, May 1932.

The writer experimented with rabbits to find out what eventually became of blood extravasated or injected into the subcutaneous tissues or peritoneal cavity and how far it resisted bacterial infection, and came to the following conclusions:—

(1) Blood which has escaped into the subcutaneous tissues clots rapidly, is quickly absorbed by the surrounding tissues, and can ultimately become organized as connective tissue.

(2) A hæmatoma shows no evidence of bacterial infection in the blood or lymphatic vessels, but it can nevertheless become infected if it happens to be in the neighbourhood of an abscess.

(3) A subcutaneous hæmorrhage has neither bactericidal power nor the so-called properties of protein bodies.

(4) The success of Läwen's method of injecting blood in the case of acute infection is brought about chiefly by the mechanical action of the free blood.

(5) Extravasated blood in the peritoneal cavity for the most part remains unclotted for a considerable time.

(6) Unclotted blood in the peritoneal cavity is rapidly absorbed. In healthy rabbits, reabsorbed blood-cells could be seen in the thoracic duct by section 8·6 minutes after injection into the peritoneal cavity, and after twenty-four hours even large quantities of blood were almost completely absorbed. All blood-clot which formed after the injection of 10 c.c. of blood into the peritoneal cavity was completely absorbed within three weeks of the injection.

(7) Blood which had been six hours within the peritoneum showed almost no change and gave rise to neither inflammation nor organization or scarring on the surface of the peritoneum.

(8) Blood extravasated into the peritoneal cavity assisted local peritoneal and general bodily resistance to bacterial infection in cases in which this experiment was performed, and although the strengthening of this resistance was not so marked as in cases where intraperitoneal blood transfusions

were given, it was more marked than in cases where intraperitoneal injections of normal saline were given.

(9) If blood which escapes into the peritoneal cavity is small in amount and sterile, and the absorptive powers of the peritoneum have not been damaged, the escaped blood remaining in the peritoneal cavity assists resistance to local and general bacterial infection. W. J. F. C.

COLONEL KATAYAMA. **Some Experiments Undertaken to show the Effect of Red Rays on the Eye, particularly with regard to the Retina and the Optic Nerve.** *Journal of the Imperial Japanese Army Medical Corps*, May, 1932.

Numerous authorities have undertaken research into the effect of radiation, and while a good many have directed their efforts to the effect of the ultra-violet rays, only comparatively few investigators have studied the effects of infra-red radiation. But their investigations do not reveal how all the visible rays—red, blue, yellow, green, etc.—individually affect the organs of sight.

The writer first of all established that the eyes were fatigued most of all by the red rays, and then looked for the changes in the eye, especially in the retina and the optic nerve, which took place as a result of the radiation with the red rays. He placed rabbits in the red rays by filtering the ordinary rays with red glass, which only allowed rays of a wave length of more than 600 $\mu\mu$ through. He investigated the clinical and histological changes in the eye of twenty-nine cases, varying the duration of exposure to the rays in different cases. He obtained the following results:—

(1) *Conjunctiva.*—Swelling of the epithelial layer, alteration in the shape of the cells, decreased staining properties and occasional empty cells here and there were observed.

(2) *Cornea.*—Again he observed swelling of the epithelial layer, alteration in the shape of the cells, decrease in the staining properties of cells, and sometimes serous cloudiness and even the appearance of gangrene.

(3) *Sclera.*—No special change.

(4) *Choroid.*—At first swelling of a non-inflammatory nature was seen, then atrophy of the tissue.

(5) *Retina.*—In cases in which there was a long exposure, changes in all layers of the retina were seen, especially in nerve-fibres, ganglion cells and the optic nerve cell layers.

(6) *Optic Nerve.*—" Osmium " bodies were first seen after eighty days, and thereafter they gradually increased in number. Finally there was marked change in each tissue, particularly in the centre of the optic disc.

W. J. F. C.

DAS GUPTA, B. M. **A Case of Blackwater Fever Treated by Atebrin.** *Ind. Med. Gaz.*, 1932, lxvii, 330.

This case occurred in a male Hindu, aged 13 years, in whom two attacks of hæmoglobinuria were considered to be due to the administration of

quinine. Under atebrin treatment, both fever and malaria parasites disappeared, as did the hæmoglobinuria; the drug was well tolerated.

The patient, who stated that he had had fever for the previous six months, was admitted to hospital on January 21, 1932. Hæmoglobinuria had occurred about two weeks before admission and after eight doses of quinine mixture (quantity not known) had been administered. An alkaline mixture was given, and the next day the urine showed abundant urobilin, but no hæmoglobin.

Ten grains of quinine (in 5-grain doses) were then administered and the patient at once commenced to pass hæmoglobinuric urine. A monkey inoculated with ten cubic centimetres of the patient's blood one hour after the onset of the hæmoglobinuria remained healthy. Also two cubic centimetres of the patient's blood inoculated into Fletcher's medium remained sterile up to twenty-two days.

On January 23 the patient was again given an alkaline mixture, with calcium lactate and parathyroid extract, but no quinine. Hæmoglobinuria gradually diminished until January 26, when it ceased.

On February 17 the patient relapsed and *P. falciparum* was seen in blood-films. Hæmoglobinuria was absent.

Commencing on February 20, atebrin (0·1 gramme), twice daily, was given for five days. The patient improved rapidly under this treatment; and when, from March 10 to 13, ten grains of quinine, in two doses, were given daily, there was no recurrence of hæmoglobinuria.

On March 14 the patient was discharged hospital.

The author considers that in atebrin we have a drug especially suitable for the treatment of malaria in subjects susceptible to quinine, and that its use in blackwater fever should be further studied.

Reviews.

WARWICK AND TUNSTALL'S "FIRST AID" TO THE INJURED AND SICK. AN ADVANCED AMBULANCE HANDBOOK. Thirteenth Edition. Edited by F. C. Nichols, M.C., M.B., Ch.B., M.R.C.S., L.R.C.P., L.D.S., (late) Captain, R.A.M.C.(T). Bristol: John Wright and Sons, Ltd. 1931. Pp. xii + 276. Price 2s. 6d. net.

The first edition of this handbook was published in 1901 and this volume is the thirteenth edition, a fact which is sufficient testimony to the usefulness and popularity of the work.

It is described in its sub-title as an "Advanced Ambulance Handbook," and the completeness of the book amply justifies that description. It is divided into two parts. Part I gives an exceedingly concise account of the elements of anatomy and physiology. Part II is in itself a textbook of First Aid, beginning with the application of bandages and ending with a

chapter on "Competition Work." There is also included a chapter on "Poisoning by Gas in Warfare."

The book is rounded off with a very necessary glossary and an excellent index.

The illustrations are a particularly good feature of the work. They are clear, very numerous and should be of great help in explaining the text. The matter of the book is clear, accurate and up to date. If we were to offer any criticism we might say perhaps that there is a mass of detail in Part I which might prove confusing to the average learner of First Aid. The chapter on gas poisoning is the one unsatisfactory chapter in the book as it consists of an unsuccessful attempt to fit the whole subject of signs and symptoms, treatment and prevention of gas poisoning into five and a half small pages.

THE ANOPHELINE LARVÆ OF THE COUNTRIES FROM INDIA AND THE ORIENT TO THE ANTIPODES. By C. Strickland, M.A., and K. L. Choudhury, M.B. Calcutta: Thacker, Spink and Co., Ltd. 1931. Pp. 36. Rs. 1-12.

This key is an enlarged edition of the one by the same authors which deals with the anopheline larvæ of India, Ceylon and Malaya.

The key strikes us as being eminently practical and therefore useful in the sphere for which it is devised. While some of the terms used are novel they are largely self explanatory and will cause no confusion. The subject matter is well illustrated by drawings, and the little book will be found most useful by practical entomologists.

TEXTBOOK OF MEDICINE. Edited by J. J. Conybeare, M.C., M.D., F.R.C.P. Edinburgh: E. and S. Livingstone. 1932. Pp. xix + 981. 21s. net.

In his preface to the first edition of this manual, the editor explained his aim of providing the essentials of medicine within as small a compass as possible, short of producing a synopsis. In its general character and scope the second edition follows the same plan. The text has been revised and parts of it rewritten so as to bring the subject matter up to date. Additions and amplifications have increased the size of the volume slightly, but in spite of this the price has been reduced.

The volume can be recommended to medical officers wishing to provide themselves with an excellent textbook of medicine of medium size.

FILTERABLE VIRUS DISEASES IN MAN. By Joseph Fine, M.D., B.Sc., D.P.H.(Glas.), D.T.M.(Liverp.). 1932. Edinburgh: E. and S. Livingstone. Pp. viii. + 144. Price 6s. net.

The literature of virus diseases has grown in bulk to enormous dimensions during the last few years, and there are few textbooks of

reasonable size that contain satisfactory accounts of these conditions. This book is an attempt to present shortly recent contributions on the causative agents of all virus diseases in man in one small volume. The work of summarizing this information is, of course, a very great task, and the author has wisely relied, for the most part, upon the excellent articles that have appeared recently in the recognized textbooks. The result is a handy little volume that contains a very large amount of information concerning the human virus diseases. Many of the articles from which the author has collected his information are, however, already summaries of a large number of original communications, and any attempt to condense further these statements may rather alter the final meaning conveyed to the reader. This may be responsible for some of the little inaccuracies that one has noticed. For instance, in discussing acute disseminated encephalomyelitis, it is not quite true to say "in anti-rabic treatment it usually occurs on the seventh day of administration of the cord." Again, the difference between the street virus and fixed virus of rabies is much more than a change in the period of incubation.

There are several typographical errors in the book, and it is rather surprising to find that the almost universal employment of *italics* in dealing with zoological and bacteriological nomenclature has not been followed.

H. J. B.

A Helminthological Survey of Southern Rhodesia. By William K. Blackie, M.B., Ch.B.Edin., D.T.M. and H.Eng. Published by the London School of Hygiene and Tropical Medicine. Pp. 91, with 7 plates of illustrations. Price in cloth 10s. 6d.; in paper 8s.

The value of such surveys, of course, depends to a very large extent upon the general plan adopted to determine the incidence of helminthic infestations. The author's decision that the women and children of the Native Reserves offer the best field for research appears to us to be sound. The women and children rarely go outside the Reserve, and are less prone to acquire infestations than the natives who are to be found in the areas just outside the towns.

Schistosomiasis, especially the urinary form, is widespread throughout Southern Rhodesia, and it is noted, a point of considerable importance, that *S. mattheei*, whose definitive hosts are cattle and sheep, can, and does, occur in man in this area. Bilharziasis is the most important helminthic disease of man in the colony, and the average incidence of the urinary type is in the region of twenty per cent. The infestation, however, is usually not heavy.

Hookworm disease appears next in importance, and here again the light character of the infestation is emphasized.

Other helminthic conditions are of a minor importance, but it is of

interest to note that *Ternidens deminutus*, a comparatively rare nematode, is to be found with a considerable degree of frequency in the south-east corner of the colony.

The monograph maintains the high standard of the "Memoir Series" of the London School of Hygiene and Tropical Medicine and forms a valuable addition to helminthological literature. H. J. B.

ANNALS OF THE PICKETT-THOMSON RESEARCH LABORATORY, 1931. Volume VII. London: Baillière, Tindall and Cox; and Baltimore: The Williams and Wilkins Company. Pp. 441 + 35 plates of illustrations. Price two guineas.

This is the fifth volume in this series of annals which deals with the pathogenic streptococci. This particular volume is concerned with the role of the streptococcus in erysipelas, measles and certain skin conditions. As in previous cases, the subject matter consists of a digest of the enormous literature that has accumulated concerning the streptococcus in the conditions mentioned, together with a large number of plates of photographs showing the colonial appearance of the various streptococci growing on Warren-Crowe's medium.

The authors believe that, when they have completed this colossal work (possibly in three or more volumes), they will be able to classify the various streptococci by means of this Atlas of Photographs.

The value of all this industry cannot be estimated until the authors have surveyed the whole field of streptococci and the conditions associated with such infections.

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VOL. LIX NOVEMBER, 1932. No. 5.

Journal
of the
Royal Army Medical Corps.

Original Communications.

A PROBLEM FOR THE REGIMENTAL MEDICAL OFFICER IN MODERN WARFARE.

By MAJOR G. P. KIDD, M.C.,
Royal Army Medical Corps.

AT a recent Medical Staff Exercise held in the Eastern Command two of the "objects of the exercise" were as follows:—

(1) Detailed reconnaissance of a prepared defensive position and arrangements for evacuating regimental aid-posts to advanced dressing stations over difficult country.

(2) To study the present regimental medical establishment and equipment of an infantry battalion.

For this purpose one problem set for syndicates was as follows:—

"*Problem* 2.—On completion of your reconnaissance state in detail what arrangements you would make for evacuation of the forward brigades' R.A.P.'s to A.D.S.'s at . . . and . . .

Note.—6″ Map in conference room shows forward line of defensive position, reserve battalion areas, inter Bde. and Btn. boundaries and positions of R.A.P.'s."

During the working of syndicates on the above problem and subsequent discussions various points were raised and problems brought to light which may be of interest both to officers who served as R.M.O.'s during the Great War and more especially to those junior officers on whom this duty may fall in the future.

To those of us who have been fortunate enough to take part in manœuvres or staff exercises during the last few years, either as students

or as members of directing staffs, it must appear more and more evident that the teaching of Medical Tactics (if this term be permitted) must be based in the future on mobile warfare and that the old fetish of a fixed line of permanent or semi-permanent defences, known so well to those who served on the Western Front during the Great War, must be discarded to a large extent for training purposes.

The purpose of this article is to study the present medical establishment and equipment of an infantry battalion in the light of modern tactics in attack and defence. For the sake of brevity it is proposed to deal with defence only as being the scheme of the particular staff exercise to which reference is made, but it will, I think, be evident that the same principles and arguments will hold good in the case of attack.

In the Great War, certainly on the Western Front, the term "defence" visualized a fixed or semi-fixed system of trenches with, perhaps, front, support and reserve lines at varying intervals seldom exceeding a total depth of 1,000 yards in the case of a battalion area.

In modern tactics however defence in depth and attack by infiltration both present a different picture. Where previously there were perhaps three companies in the line with one in support or reserve there will now frequently be not more than the equivalent in personnel of one company in the forward defended localities (including probably parts of two rifle companies and the machine-gun company) with the remainder of the battalion echeloned in depth behind. Although the forward positions may extend over a frontage of 1,500 to 1,700 yards, these can be held by the equivalent of one company owing to the power of machine-guns and light automatics in defence.

A reference to Field Service Regulations, Volume II, will make clear what stress is laid on this principle of employment of troops in depth. (The following quotations are given *in extenso* for the sake of any readers who may not have a recently amended copy of this book at hand).

Section 77 (3).—". . . the principles of defensive action are constant, and may be summarized as follows :—

"v. Defence in depth is essential in order to resist an attack supported by modern weapons."

Section 78 (10).—"The strength of the defence will be increased . . . . . . if the position consists of a network of defended localities echeloned in depth . . . The greater the depth of the defensive position . . . the greater will be the enemy's difficulties in maintaining the impetus of his attack."

Again in Infantry Training, Volume II, one finds the following :—

Section 19, iii.—". . . depth is essential to localize the effects of a successful surprise attack. . . ."

What then is the effect of this teaching when applied to medical arrangements in the forward area?

Before studying this problem in detail it is necessary to visualize the

infantry battalion of modern War Establishments and the personnel and equipment at the disposal of the R.M.O. This is shown in the following tables:—

(1) SUMMARY OF WAR ESTABLISHMENTS ISSUED WITH ARMY COUNCIL INSTRUCTIONS FOR AUGUST 8, 1928.

An Infantry Battalion.

(H.Q. Wing, 1 Machine-gun Company and 3 Rifle Companies.)

Total Establishment (including attached) = 831.

H.Q. Wing, No. 1 Group—	Battalion headquarters ...	...	85
	Signallers ...	...	
	Intelligence section	...	
	Medical officer ...	...	
	M.O.'s orderly ...	...	
	Stretcher bearers, etc.	...	
No. 2 Group—	Anti-tank platoon of 4 guns	...	19
No. 3 Group—	Quartermaster's department	...	103
	Transport ...	...	
	Pioneers	...	
	Police, etc. ...	...	

Machine-gun Company—H.Q. and 4 platoons of 4 guns each—171.
3 Rifle Companies—H.Q. and 4 platoons of 4 sections each—151 each.

(2) MEDICAL PERSONNEL AND EQUIPMENT OF AN INFANTRY BATTALION.

Personnel. H.Q. Wing— 1 M.O.
1 M.O.'s orderly (Lce. Corp).
1 M.O.'s batman groom.
1 Serjt. } Stretcher bearers found from band.[1]
20 O.R.s }

[1] *Field Service Regulations, Volume I, Section* 113.

"(1) In those units which may have need of stretchers in war certain personnel are trained as regimental stretcher bearers (see paragraph 777, K.R.)."

"When an action is expected the regimental stretcher bearers are placed under the orders of the unit medical officer . . . . . ."

R.A.M.C. Training, paragraph 202.

". . . . . . When an action is imminent the regimental stretcher bearers are placed under the orders of the M.O. . . ,"

King's Regulations, paragraph 777 (*a*).

"In the arms mentioned below personnel, up to the numbers shown, will be trained in peace as stretcher bearers . . . . . . and in first aid to the wounded:—

Foot Guards.—36 N.C.O.s and men for each battalion.

Infantry of the Line.—All N.C.O.s and bandsmen included in the peace establishment of the band."

(The peace establishment for a regimental band gives 36 bandsmen, but of these 16 are only "acting bandsmen" and therefore not available as stretcher bearers in war.

Personnel.	H.Q. Wing— (continued)	2 Water duties 3 Sanitary duties	Found from pioneers.[1]
	4 Coys. each—	1 Water duties 2 Sanitary duties	When required.[1]
Transport.	H.Q. Wing—	1 Riding horse (for M.O.).	
		1 Maltese cart (medical equipment).	
		2 Water carts.	
Equipment.	Medical—	2 Water bottles.	
		1 Case, water testing, poison.	
		2 ,, ,, sterilization.	
		1 Medical Companion.	
		1 Surgical haversack.	
		24 Shell dressing haversacks.	
		1 Regt. medical pannier.	
		3 Thomas' splints, arm.	
		3 ,, ,, knee.	
	Ordnance—	12 pairs scissors, stretcher bearers.	
	A.F.G. 1098/701.	12 Stretchers.	
		3 Bars, suspension.	
		4 Slings.	
		22 Armlets S.B.	
		1 Brassard.	
		914 First field dressings.	

It will, I think, be evident that any increase in the depth of a defensive position held by a battalion will entail the regimental stretcher bearers collecting wounded over a far larger area than was formerly the case.

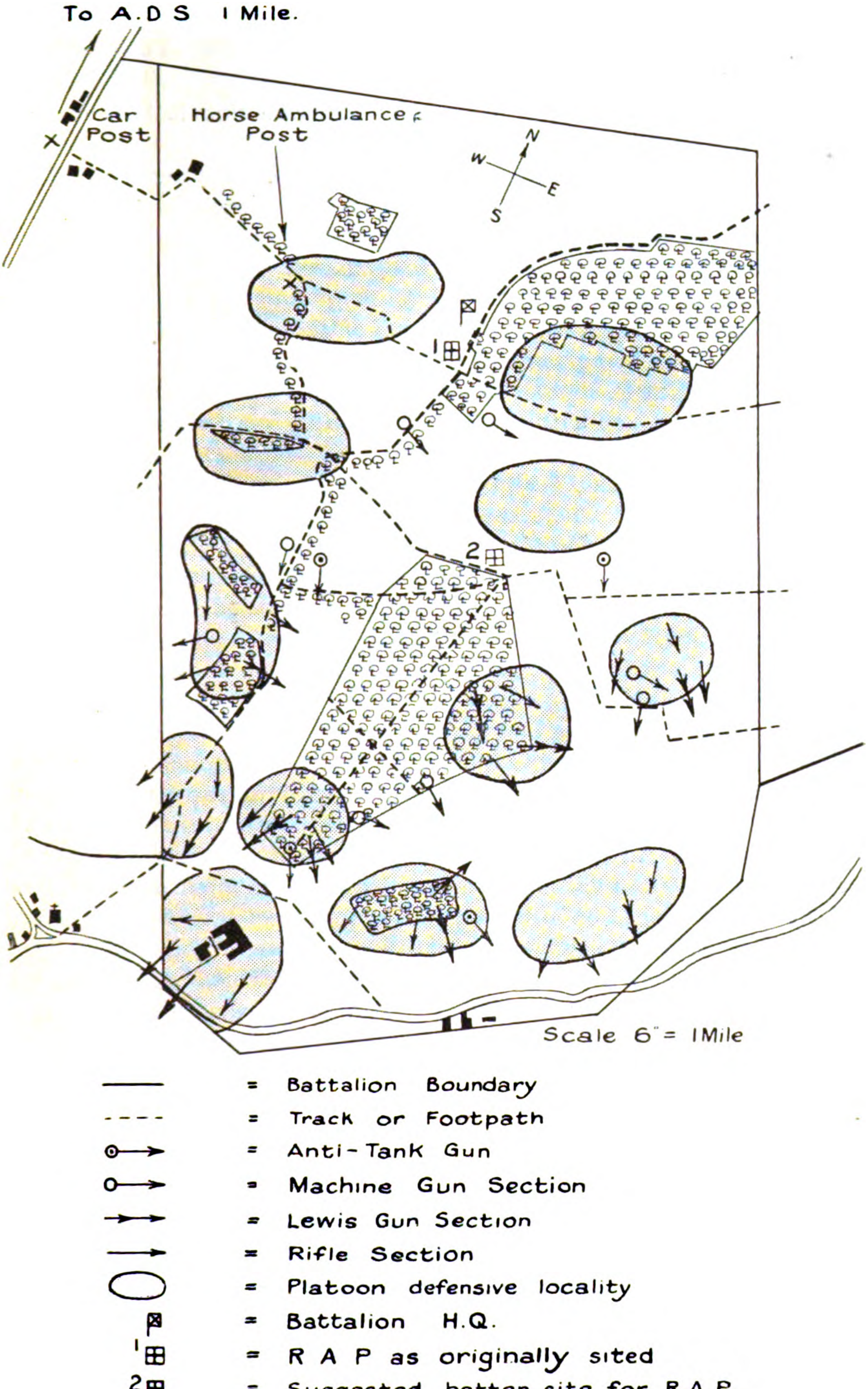
The accompanying sketch map drawn to scale from the actual "G" Staff tracing of the defensive position of one infantry battalion on a recent Eastern Command Staff Exercise will show clearly how a battalion may be disposed in defence and how large an area may be involved. It will be noted that the scale of the map is 6 inches to 1 mile, and that therefore although the battalion front is only some 1,700 yards the depth of its defensive area has a maximum of nearly 1,900 yards.

For purposes of clarity minor features have been omitted; the ground must be visualized as closely enclosed by hedges and ditches, and with few open spaces larger than the ordinary sized field.

Over the whole of this area of about a square mile the twelve platoons of the three rifle companies are spaced with the four platoons of the machine-gun company also distributed throughout.

The problem which faces the R.M.O. is to attend to and arrange the

[1] It should be noted that there is no mention in F.S.R. or R.A.M.C. Training of the sanitary and water duty men being placed at the disposal of the R.M.O during an engagement, though R.A.M.C. Training, paragraph 202, states that the M.O. is responsible for the efficiency of their work.


To A.D S 1 Mile.
Car Post
Horse Ambulance Post
N
W
E
S
1
2
Scale 6" = 1Mile
= Battalion Boundary
= Track or Footpath
= Anti-Tank Gun
= Machine Gun Section
= Lewis Gun Section
= Rifle Section
= Platoon defensive locality
= Battalion H.Q.
= R A P as originally sited
= Suggested better site for R.A.P.

evacuation of wounded from such an area with what means are at his disposal.

He must first decide where to site his R.A.P.

Let us turn again to F.S.R., vol. I; here we find it laid down as follows:—

Section 114 (1).—"Commanding officers of units will arrange, in conjunction with the unit medical officers, for the selection and notification to all ranks of a locality at which the first treatment for the wounded during an action may be administered by medical officers. This locality is named the regimental aid-post (R.A.P.).

(2) The principles guiding the selection of the position and movements of the R.A.P. in varying tactical situations are dealt with in R.A.M.C. Training. The R.A.P. should be so situated that the medical officer may be able to keep in touch with the situation during operations *through unit headquarters*."

Reference to R.A.M.C. Training gives us as follows:—

Paragraph 211. " . . . . the O.C. will, in conjunction with the M.O. of the unit, select a site for the R.A.P. This should be central and *near the unit headquarters* with easy access from all parts of the front held by the unit."

Paragraph 202. " . . . . In technical matters the officer in medical charge of the unit is directly under the A.D.M.S., but in all other respects he is under the orders of the unit."

In the above extracts we find it twice clearly laid down that the R.A.P. shall be near the battalion headquarters. This, on the face of it, appears logical; it is convenient for purposes of intercommunication, should ensure the M.O. always obtaining early information regarding any change in the situation and the R.A.P. should be easily found, both by his stretcher bearers from the front of the area and by field ambulance bearers from the rear, since the position of battalion headquarters is usually well known.

This idea worked very well in position warfare when the battalion headquarters was seldom far behind the support line, but what is the position when we consider an area as shown in the sketch map where we find headquarters some 1,800 yards from the foremost defended position as must not infrequently be the case owing to the nature of the ground?

The recent Eastern Command Medical Exercise was based on a previous Command Staff Exercise comprising the rapid advance of a corps of three divisions followed by a short withdrawal to a prepared defensive position. For the purposes of the Medical Exercise one division only was dealt with; the position of the six forward battalion headquarters on a two-brigade front of the prepared defensive position was given by the "G" Staff and for Problem No. 2 the R.A.P.'s were presumed to be at or near these headquarters in accordance with R.A.M.C. Training, paragraphs 202 and 211.

In point of fact the approximate distances of the six R.A.P.'s, as thus sited, from the foremost defended locality of each battalion were 975, 1,275,

1,350, 1,350, 1,650 and 1,500 yards, i.e., an average of approximately 1,350 yards from the front line. Each battalion area was approximately the same size as that shown on the sketch map.

If the reader will glance again at the table of regimental medical personnel and equipment he will see that a total of twenty stretcher bearers and twelve stretchers only is at the disposal of the R.M.O.; with these he is responsible for the collection of wounded over an area of approximately one square mile, varying in width and depth from 1,000 to 1,800 yards, with small scattered defended localities and a possible complete or almost complete absence of communication trenches and definite paths or tracks.

It should be borne in mind that although a regimental stretcher squad consists of two men instead of four as in the R.A.M.C., ten such squads only are available with a reserve of two stretchers to replace losses or those not returned from the A.D.S. in exchange.

Now the maximum distance over which a stretcher squad of even four bearers as in the R.A.M.C. should be expected to carry a wounded man is about 500 yards; they can, of course, carry much further, but if they are asked to do so they will soon become exhausted; carrying heavy men on stretchers is extremely hard work. In the present case, with distances of some 1,300 yards entailed, it is clear that at least one relay squad will be necessary to evacuate a case from any of the forward defended localities. A further glance at the sketch map will show five such forward localities in the area at an average distance of 1,350 yards from the R.A.P. sited close to battalion headquarters. All ten available squads of regimental bearers will therefore be required to clear these five forward positions in the event of an engagement resulting in casualties distributed throughout the area. This leaves no available bearers to deal with the seven remaining platoons in close support or reserve, in all or any of which casualties may be expected if the area is shelled or bombed. The same will apply in the case of stretchers, of which, out of a total of 12 in the battalion, 10 will be required for the 5 forward platoons, leaving 2 only in reserve.

Two main conclusions then may be drawn from a study of the problem as given.

Firstly, that the present regimental establishment and scale of stretchers and bearers is insufficient in the case of a battalion occupying a defensive position in depth.

Secondly, that the position of the R.A.P., as laid down in F.S.R. and R.A.M.C. Training, i.e., near the battalion headquarters, will in most cases be too far back in an area such as has been depicted.

As a result of the recent Medical Exercise the general opinion was that the R.A.P. should not be more than 1,000 yards behind the forward defensive localities; this will give two "carries" of 500 yards each for stretcher bearers, thus necessitating one relay squad for each such forward post. But even allowing this it will still be obvious that the present establishment of stretcher bearers and scale of stretchers is insufficient;

neither gives any margin for reserve and neither allows sufficient for the support and reserve area of the battalion. It is considered that a total of 36 bearers and 24 stretchers is essential, thus giving 18 squads and a reserve of 6 stretchers.

R.A.M.C. Training, paragraph 429, states that an A.D.M.S. can and should apply to his Divisional Staff for extra personnel from combatant units in reserve if he considers that the R.A.M.C. bearers of the division require augmenting, but there is no mention here nor in F.S.R. of any such possible augmentation in the case of regimental bearers, although reference to the Official History of the War—"Casualties and Medical Statistics" page 24—shows that these were increased from 16 to 32 per battalion during the battle of the Somme in 1916. Presumably the R.M.O. can and will apply to the O.C. of the battalion for extra bearers if required, but one can well imagine an O.C. being unable to spare fighting men from platoons in times of stress. True, in the battalion we have 6 water duty and 11 sanitary duty men who are to a certain extent under the R.M.O., but these again are included in the fighting establishment of the H.Q. wing and companies and an O.C. might find it difficult to spare them for stretcher-bearing duties, in which duties also they would be untrained.

One other source is possible but is unlikely to be available in defence, i.e., the use of prisoners of war as laid down in R.A.M.C. Training, paragraph 385.

It would seem, therefore, that the only solution is to increase the establishment of stretcher bearers in a battalion from 20 to 36, either by utilizing the remaining 16 "acting bandsmen" mentioned in Peace Establishments or by training a further 16 men from companies and making them definitely available for this duty. In this connection there appears to be no valid reason why a Line battalion should not be allowed the same number of bearers as a Guards battalion, since their role in action is exactly the same.

At the same time an increase in the scale of stretchers from 12 to 24 is strongly indicated for the reasons given.

If these recommendations are accepted, however, a further problem will arise regarding the carriage of the extra 12 stretchers of an infantry battalion.

The transport at the disposal of the R.M.O. (*vide* page 324) consists of one Maltese cart only for medical equipment, and it is obvious that the additional stretchers could not be carried thereon.

The battalion transport includes 7 wagons, L.G.S., in the H.Q. wing, 12 in the M.G. company, and one in each rifle company, but each of these is earmarked for some special load—S.A.A., machine-guns, tools, signal stores, etc.—and no stretchers could be carried in addition.

The attached transport from the divisional R.A.S.C. consists of 7 light lorries, 2 for baggage, 3 for great-coats and 2 for supplies. These again will in all probability be fully loaded, except in the case of a battalion

occupying a fixed position, in which case the baggage and great-coat lorries might be empty.

It would appear then that there is at present no means of carrying the twelve extra stretchers within the battalion unless some extra transport, say, one L.G.S. wagon, is provided for the purpose; the provision of any extra transport, however, is extremely unlikely in view of the present tendency to reduce as far as possible the already enormous numbers of transport vehicles in a division.

The extra stretchers are only required when the battalion is actually engaged, and it would therefore appear to meet the case if these could be made available somewhere in the rear, either in the divisional or even the corps area, to be sent up at the discretion of the A.D.M.S. only if and when required.

Three possibilities for their storage and carriage are as under :—

(*a*) With the field ambulances.

(*b*) With the divisional R.A.S.C.

(*c*) With the corps motor ambulance convoy.

In the case of (*a*) the field ambulance transport is already heavily loaded with technical and other stores, and no spare vehicles are available for the forty-eight extra stretchers of one brigade.

In the case of (*b*), although at first sight this would seem a suitable solution, in that the twelve stretchers could be divided for carriage among the five baggage and great-coat lorries attached to each battalion and delivered to or dumped at the unit transport lines if and when required, it must be remembered that stretchers are part of the technical medical equipment of the Army, and that being placed in charge of a non-medical unit might lead to their being used for other than the proper purpose, with consequent loss and breakage.

It appears, therefore, that the best solution is to place them on the charge of the motor ambulance convoy. These are medical units, possess 75 motor ambulances, and are mobilized on the scale of one per each corps of two divisions. Each division would have 144 extra stretchers, i.e., 12 per battalion, which gives a total of 288 to be carried by the M.A.C. It is considered that this is quite possible by placing four extra stretchers in each motor ambulance in addition to those already carried.

In this way 288 extra stretchers would be at the disposal of the D.D.M.S. of each corps for issue to divisions as and when required. In this connection it should not be necessary to issue extra stretchers to a brigade in reserve until there is prospect of it becoming engaged in battle, thus giving each A.D.M.S. a floating reserve of 48, which could be utilized to replace losses or to form dumps in the battle zone.

There should be no difficulty in delivering the extra stretchers to battalions in the forward zone through the field ambulances, as M.A.C. cars could deliver them to the main dressing stations prior to an engagement, whence they could be drawn by battalion transport.

The above remarks are not intended to provide a definite solution, but merely to present a new and, I believe, so far unconsidered problem, and to suggest alternative solutions thereto for consideration and study by those who may be interested in the training of the Medical Services under modern conditions of warfare.

This article has been written at the suggestion of Major-General H. Ensor, C.B., C.M.G., C.B.E., D.S.O., K.H.S., Deputy Director of Medical Services, Eastern Command, and Director of the Medical Exercise in question, to whom I am indebted for much essential help and advice.

FURTHER INVESTIGATIONS INTO THE CHARACTERS AND CLASSIFICATION OF THE MANNITE-FERMENTING DYSENTERY BACILLI.

By Major J. S. K. BOYD,
Royal Army Medical Corps.

(*Continued from p.* 251.)

Pathogenicity.—All 28 strains isolated in Bangalore and Poona by the writer were from typical cases of dysentery. Twenty-seven were from cases showing bacillary exudate, and 1 from an indefinite exudate. One case—a child of 1 year—progressed to a fatal termination. On the two occasions on which a suitably fresh specimen was received for examination from this case, a rich culture of 103 was obtained. It is interesting to note that therapeutic serum had no apparent action on the case. As no specific antibody for 103 is embodied in the serum this result is what might be expected.

In two cases this type was encountered in a mixed infection, the other organisms being W and 170.

It has never been found in the 8,000 controls.

No further tests with the serum of cases have been carried out. Despite the absence of confirmation by this test, no reasonable doubt is entertained that 103 is a widespread cause of bacillary dysentery.

(4) *Type* 170.

This organism has been isolated from 19 cases, viz., 9 from Bangalore, 7 from Poona, 1 from Secunderabad, 1 from Quetta, and 1 from Meerut.

Description of the Organism.—The biochemical reactions are identical with those of classical Flexners.

Serologically the type is a distinct and separate entity. It is not agglutinated by high-titre sera of any of this series, neither does 170 serum agglutinate any of the other types.

Its agglutinogenetic properties are moderate.

No variations within the type have been found. All strains agglutinate to titre of the serum, producing somewhat heavier flocculi than is common with dysentery bacilli.

Mutation.—No antigenic change has occurred in any of the strains, some of which are now over two years old.

Pathogenicity.—Of the 16 cases investigated in Bangalore and Poona, 11 showed typical bacillary exudate, 4 indefinite exudate, and one was from a case of diarrhœa. In one case, 170 occurred in conjunction with 103.

170 has shown the usual cycle of incidence in acute cases, and has not been isolated from the 8,000 control platings.

Agglutination tests with the patient's serum and the homologous organism have been tried in 5 cases, all with negative results.

On the whole it is considered probable that 170 is a cause of dysentery, but in view of the antigenic dissimilarity from the classical Flexners, more experience is necessary before a final judgment can be given.

(5) *Unclassfied Strains.*

There remain 11 strains of organisms giving these biochemical reactions which are serologically different from the foregoing types.

Sera have been prepared for some of these, and lead to the following further classification (*vide* Table XII).

TABLE XII.

		Serum					
		181	197	200	B 161a	P 143	
Organism ..	Strain No. 73	—	—	—	—	—	Alike in not fermenting mannite for 72 hours
	Md. 2	—	—	—	—	—	
	143	—	100	—	—	—	Alike
	197	—	100	—	—	—	
	B 161a	—	—	—	100	—	Alike
	P 602	—	—	—	100	—	
	181	100	—	—	—	—	Serological entity
	200	—	—	100	—	—	,, ,,
	P 143	—	—	—	—	100	,, ,,
	Dec. 10	—	—	—	—	—	
	P. 373	—	—	—	—	—	

Brief Notes on these Strains.

73 *and Md.* 2. Both were isolated from typical cases of dysentery with bacillary exudate. No other organisms isolated.

143 *and* 197. One from a routine examination of a food handler, the other from a case of diarrhœa with no blood and mucus. The organism has well-marked agglutinogenetic properties.

B 161*a and P* 602. Both were from cases of diarrhœa with mucus, microscopically not a typical bacillary exudate. The colonies of P 602 were rough in appearance on the original plate. Moderate agglutinogenetic properties.

181. From a case of neurasthenia with occasional loose stools. No mucus. Never suggestive of dysentery. Organism isolated on one occasion only of many examinations made.

Of low agglutinogenetic power.

200. Isolated on one occasion only from a case of dysentery during convalescence. No organism isolated during the acute stages. Well-marked agglutinogenetic properties.

P 143. A typical case of bacillary dysentery. Organism isolated during acute stage. Has moderate agglutinogenetic properties.

Dec. 10 *and P* 373. Accidentally overlooked and no serum has been prepared. They may therefore be alike or distinct serologically. They have no serological relationship to any other organism studied.

(*b*) *Subgroup B.*

While the creation of a subgroup based on the fermentation of dulcite may be questioned, the arrangement in practice is a convenient one, and prevents the previous subgroup from becoming top heavy. There is evidence of inter-relationship in that two of the types in this section produce heterologous agglutinins for the classical Flexners.

Tables XIII and XIV show the biochemical and serological characters of the various types in the subgroup.

TABLE XIII.—BIOCHEMICAL REACTIONS OF SUBGROUP B.

	Lactose	Glucose	Mannite	Dulcite	Saccharose	Milk	Indol
88	—	A	A	A 10th day	—	A Ft. alk. 15th day	—
P 288	—	A	A	A 5th day	—	A Alk. late	—
D 1..	—	A	A	A 3rd day	—	A Alk. late	—
D 19	—	A	A	A 3rd day	—	A Alk. late	—
P 274	—	A	A	A 10th day	—	A Alk. late	—
B. alkalescens	—	A	A	A 3rd day	—	A Alk. 3rd to 5th day	+

Note: the above times refer to cultures in media with a pH value of 7·4, and are averages.

TABLE XIV.—SEROLOGICAL REACTIONS OF SUBGROUP B.

	Organism					
	88	P 288	P 274	D 1	D 19	*B. alkalescens*
Serum of 88	100	—	—	—	—	—
,, ,, P 288 ..	—	100	—	—	—	—
,, ,, P 274 ..	—	—	100	—	—	100
,, ,, D 1	—	—	—	100	—	—
,, ,, D 19	—	—	—	—	100	—
,, ,, *B. alkalescens*	—	—	—	—	—	100

From this it will be seen that, except in the case of P 274 and *B. alkalescens*, the types have no common antigen.

Mutation.—There is no evidence of the occurrence of true mutation in

this group. On isolation the colonies are "smooth" in every way. Strains of all types which have been kept in artificial culture over long periods show superficial roughness to a greater or lesser extent. These all, however, emulsify readily, grow in broth without depositing, and agglutinate to titre with the serum made from smooth strains.

(1) *Type* 88.

Thirty-nine strains of this organism have been isolated or identified by us, 16 from Bangalore, 15 from Poona, 1 from Belgaum, 5 from Secunderabad, 1 from Jubbulpore, and 1 from Quetta. Strains have also been reported from Wellington and Razmak.

The biochemical reactions are as in Table XIII. In about one-third of the strains dulcite is not fermented. Alkali formation in milk does not occur till the second week, and is always faint.

The serological reactions are shown in Table XV. A fairly close relationship to the classical Flexners can be seen. Absorption tests recorded in a previous article [4] show that the "88" antigen is a separate entity.

TABLE XV.

	V	W	X	Y	Z	P 119	103	170	88	P 288	P 274	D 1	D 19	*B. alkalescens*	*B. dys.* Sonne
88 agglutinated by the sera indicated	—	5	—	—	—	—	—	—	100	—	—	—	—	—	—
88 serum against organism indicated	20	30	—	20	—	—	—	—	100	—	—	—	—	0·5 per cent	—

Pathogenicity.—Thirty cases have come under the writer's observation. Of these, 22 were typical dysentery with bacillary exudate, 5 were dysentery with indefinite exudate, and 3 were from cases with a history of dysentery which had however passed the acute stage.

No other dysentery organism has ever been recovered in association with "88," nor has this organism ever been found in the control series.

Agglutinins for "88," and also for some of the classical Flexners, particularly "W", develop in the serum of patients infected with this

TABLE XVI.

	V	W	X	Y	Z	88
Patient's serum, 11th day	$\frac{1}{25}$	$\frac{1}{35}$	—	$\frac{1}{25}$	$\frac{1}{25}$	$\frac{1}{175}$
,, ,, 17th day	$\frac{1}{50}$	$\frac{1}{100}$	—	$\frac{1}{25}$	—	$\frac{1}{250}$
,, ,, absorbed "W" ..	—	—	—	—	—	$\frac{1}{250}$
,, ,, absorbed by homologous strain	—	—	—	—	—	—

organism. Saturation of such a serum with "88" removes all the agglutinins, whereas the classical Flexners are capable of removing only their own (therefore heterologous) agglutinins.

Table XVI shows the findings in one case that was investigated in this way.

This type is definitely regarded as a cause of dysentery.

(2) *Type P* 288.

Thirteen strains of this organism have been isolated, 11 in Poona, 1 in Secunderabad, and 1 in Bombay.

Description of the Organism.—The biochemical reactions of P 288 are shown in Table XIII.

Serologically, as will be seen from Table XVII, a certain relationship to the classical Flexners exists. Although not agglutinated by the classical Flexner sera, a P 288 serum contains a proportion of heterologous agglutinins for these types. The organism has well-marked agglutinogenetic properties.

TABLE XVII.

	V	W	X	Y	Z	P 119	103	170	88	P 288	P 274	D 1	D 19	*B. alkalescens*	*B. dys.* Sonne
P 288 agglutinated by sera indicated	—	—	—	—	—	—	—	—	—	100	—	—	—	—	—
P 288 serum with organism indicated	5	—	5	5	12·5	—	—	—	—	100	—	—	—	—	—

Pathogenicity.—Of the 11 Poona strains, all were from clinical bacillary dysentery, 9 being from stools showing bacillary exudate, and 2 from indefinite exudate. The Bombay strain was from a case of acute dysentery in a child.

The incidence of these cases is interesting. Nine of the Poona cases occurred between 20.6.31 and 6.8.31, and the remaining 2 cropped up simultaneously in an officer's mess in January, 1932, 5 of the 9 cases occurred in one regiment with the date of onset as follows: 16.7.31, 21.7.31, 26.7.31, 3.8.31, and 6.8.31.

No mixed infections have been discovered nor has the organism ever been found in the 8,000 controls. It has been found only during the acute stages of the cases.

In one case the patient's serum was examined for specific agglutinins with negative result.

It is considered that the evidence is in favour of pathogenicity because of (*a*) the fact that the organism has only been isolated from cases of clinical bacillary dysentery; (*b*) the definite connection between certain cases suggesting infection from a common source; and (*c*) the serological relationship to the classical Flexners.

(3) *Type P* 274.

Of this type only nine strains have been encountered. Four of these occurred in the Secunderabad series, two were found in Bangalore, two in Poona, and one in Quetta.

The *biochemical reactions* call for no particular comment, being as shown in Table XIII. The fermentation of dulcite occurs between the eighth and sixteenth days. Indol is not formed. (Note the corresponding reactions in *B. alkalescens*.)

Serological Reactions.—P 274 is not appreciably agglutinated by high-titre sera of any other members of the series, and P 274 serum has no action on any of the organisms with the exception of *B. alkalescens* (Andrewes) which is agglutinated to titre. Absorption tests gave the results shown in Table XVIII.

TABLE XVIII.

Serum	Organisms	
	B. alkalescens	P 274
B. alkalescens	100	0.5
P 274	100	100
P 274 absorbed P 274 ..	1	2
P 274 absorbed *B. alkalescens*	2	20

It will thus be seen that while P 274 serum has marked heterologous agglutinins for *B. alkalescens*, the reverse is not true. Each possesses an antigen peculiar to itself.

P 274 has good agglutinogenetic properties.

Pathogenicity.—The four Secunderabad strains were all from cases of clinical dysentery with bacillary exudate. Of four strains isolated by the writer, two were from dysentery cases with bacillary exudate, one from a case with indefinite exudate, and one from a case of intermittent diarrhœa. In one of these dysentery cases the organism was found on four successive days during the acute stage, never later. Tests of patient's serum for specific agglutinins in this case proved negative.

This type has never been encountered other than as above.

Although, therefore, there is a certain amount of evidence in favour of P 274 being pathogenic, it is not yet possible to express a definite opinion on the subject.

(4) *Type D* 1.

This is a serological type regarding which very little first-hand information can be given. Of the thirty-seven strains of "non-agglutinable Flexner" collected by Major W. Walker, R.A.M.C., in Secunderabad, and very kindly handed over to the writer, seven were found to be of this type.

No similar strains were found in Bangalore or Poona till August, 1931, when two were isolated. These nine strains are all that have come to hand.

Biochemical reactions appear in Table XIII. It will be seen that, as with *B. alkalescens*, dulcite is fermented early, i.e., on the second or third day. Alkali formation in milk is, however, late and slight.

Serological Characters.—This type is of completely different antigenic pattern from the classical Flexners. It is agglutinated by no serum in this series other than its own. Conversely D 1 serum contains no heterologous agglutinins. Its agglutinogenetic properties are not of a high order.

Pathogenicity.—Of the two Poona strains one was from a typical bacillary dysentery with bacillary exudate, the other from a more doubtful case with indefinite exudate. The seven Secunderabad strains were all from cases of clinical dysentery, five of which showed bacillary exudate and two indefinite exudate.

It has not been possible to test the agglutinin content of the serum of patients from whom this organism has been recovered.

While it is possible that the organism may be a cause of dysentery, there is not sufficient evidence available to admit of this being definitely asserted.

It seems probable that this type will prove to be of common occurrence in other parts of India, although it is a rarity in Bangalore and Poona.

(5) *Type D* 19.

Only two strains of this type have been found, both in the Secunderabad series. Both isolations were from cases of bacillary dysentery with typical bacillary exudate.

The biochemical and serological reactions can be seen in Tables XIII and XIV. The organism has well-marked agglutinogenetic properties.

It is impossible to say from the evidence available whether D 19 is pathogenic or not.

(6) *B. alkalescens* (*Andrewes*).

This has been found five times, three times in Poona and twice in Bangalore.

The biochemical reactions at once distinguish it from other members of the group. Dulcite is rendered acid about the third day. Milk, at first acid, becomes alkaline between the third and fifth days, the degree of alkalinity ultimately being intense. Indol is formed in peptone water. *B. alkalescens* is the only indol-forming member of the subgroup.

The serological characters can be seen in Tables XIV and XVIII.

Pathogenicity.—All five strains were recovered from the stools of normal individuals. There is, therefore, no suggestion of pathogenicity, a finding which accords with the opinion formed by Andrewes [5].

(7) *Unclassified Strain.*

One other dulcite-fermenting strain has been isolated which has no serological relationship to these described.

It was found in the routine examination of a normal individual.

(*c*) *Subgroup C.*

This subgroup comprises over eighteen per cent. of the 1930-31 series.

It has been only somewhat superficially investigated, having been set aside for more detailed consideration when the work on the other subgroups should be completed. A transfer from practical work has rendered this impossible so far as the writer is concerned, but the work will shortly be taken up in another laboratory.

The principal member of the subgroup is, of course, *B. dysenteriæ* Sonne, whose pathogenic properties are well known.

No attempt has been made to classify the remainder of the strains serologically. No doubt *B. dispar* (Andrewes) and the various brands of *B. metadysenteriæ* (Castellani) are included, but in the absence of identification by agglutination it is impossible to be certain.

The early production of colonies which are at least superficially "rough" (R) is a well-marked feature of this group. It is typified in the case of *B. dysenteriæ* Sonne which, although usually "smooth" (S) when isolated may begin immediately to become R, and may be almost completely R within twenty-four hours. For this reason it is advisable to use for diagnostic purposes a serum capable of agglutinating both the S and the R variants, as otherwise strains which have undergone an early change to R may be missed.

Similar rapid mutation to R has been observed in all strains of this subgroup which have been studied. Many are completely R on the original plate made from the patient's stool. For this reason it is thought that such strains may be much commoner than the figures given here indicate. When typical S colonies are present on a plate, investigations, especially during the rush season, are apt to be confined to these to the exclusion of any R colonies which may be present, which are consequently "missed." Of course there are many blue colonies with R characters which are totally unrelated to the group under discussion.

These R strains of subgroup C show well-marked differences from the R strains of subgroup A (i.e., the classical Flexners). Colonies of the latter not only appear "rough" physically, but also grow as a deposit in broth and auto-agglutinate in 0·9 per cent. saline. The subgroup C "R" strains have not these characters. Although to look at they are extremely "rough" colonies, they grow uniformly in broth, and readily emulsify in 0·9 per cent saline. *B. dysenteriæ* Sonne nevertheless shows the same complete change of antigen in its mutation from S to R as do the classical Flexners.

In this connection there is a further point of considerable interest. The classical Flexners (V, W, X, Y, Z) have R variants with a common antigenic pattern, i.e., a serum which agglutinates V R will agglutinate equally W R, X R, etc. This is not so in subgroup C. Sonne R serum will not agglutinate any of the others, a fact which suggests the possibility that there may be a fundamental serological difference between these biochemically similar types, and is in keeping with the suggestion that while Sonne is definitely pathogenic, these others probably are not.

(1) *B. dysenteriæ* Sonne.

As this is a well-known type only a few salient points regarding it will be mentioned.

Biochemical Reactions.—The acid production in lactose and saccharose is generally described as taking place from the third to the fifth day, or at any rate within the first week. With the strains isolated and the media used in India this period has been more protracted, the average of twenty-six strains being fourteen days in the case of lactose, and 14·5 in the case of saccharose.

Indol is never formed.

Serological Characters.—Attention is again drawn to the rapidity with which R variants may be formed. They are not infrequently seen on the original plate made from the patient's fæces. This organism is a serological entity and produces no co-agglutinins for either of the other subgroups.

Pathogenicity.—Of the 31 strains isolated by the writer, 29 were from typical bacillary dysentery with bacillary exudate, and 2 from less definite cases.

In two cases Sonne occurred in conjunction with other organisms (one a "V" the other a "W"). The serum of 6 cases was tested for agglutinin production with negative result.

Infection with this organism is of common occurrence in children. Of the 31 strains, 8 were from children and 2 from enlisted boys.

(2) *Unclassified Strains.*—In all, 39 strains have been isolated, 3 of these being sent from other laboratories.

Biochemical Reactions.—The acidification of lactose and saccharose is very irregular. 26 strains produced acid in both these sugars; 9 in lactose only, and 4 in saccharose only. The period varied from one to twenty-seven days. It is possible that the non-lactose fermenters and the non-saccharose fermenters may represent different types, but the data have not been sufficiently confirmed to justify any expression of opinion.

A point worthy of note is that seventeen or nearly fifty per cent of the strains form indol, in contrast to the true Sonnes, where indol production has never been found.

Serological Reactions.—None of these strains are agglutinable with any of the sera prepared in this investigation against which they were tested (the earlier strains were discarded before the later sera were prepared).

An attempt to prepare a serum for one strain repeatedly isolated from a case of clinical dysentery with bacillary exudate was quite unsuccessful. In another case a weak serum with a titre of $\frac{1}{250}$ resulted.

Pathogenicity.—The following list summarizes the types of case from which the thirty-six strains were recovered :—

(*a*) Clinical dysentery with bacillary exudate and no known pathogenic organism isolated	11
(*b*) Clinical dysentery with indefinite exudate and no known pathogenic organism isolated	1
(*c*) Diarrhœa—no exudate	4
(*d*) Clinical dysentery with bacillary exudate, but recognized pathogenic dysentery organisms isolated as well as this type	12
(*e*) Convalescent dysentery	3
(*f*) Cases with no intestinal symptoms	5

The biochemical reactions afford no help in the detection of pathogenic strains. Thus groups (*a*), (*b*) and (*c*) above include strains which ferment both lactose and saccharose ; strains which ferment lactose and not saccharose, and vice versa; and strains which produce indol as well as strains which do not.

Group (*d*) is significant, and strongly suggests that Groups (*a*) and (*b*) represent a similar state of affairs with the causative organism missed.

In only three cases did colonies occur on the original plate in a way which was regarded as " suspicious " or " likely."

While it is possible, therefore, that some of these strains may be pathogenic, it seems fairly certain that the majority are not, and it is considered that all should be regarded as non-pathogenic till evidence to the contrary is forthcoming. There is little doubt that these are the strains which have damaged the faith of the clinician in regard to the diagnosis of " non-agglutinable " Flexner, as for the first few days they present the correct biochemical reactions and would therefore be reported as Flexner.

E. Analysis of Results.

This research has been in progress for three years. During this period every non-motile coliform organism, non- or late-lactose fermenting, and acidifying without gas glucose and mannite, isolated either from dysentery cases, from routine fæces examination, or sent by other laboratories, has been kept and fully investigated. Exclusive of " classical " *B. dysenteriæ* Flexner and *B. dysenteriæ* Sonne, 214 strains have come to hand. Of these, 13 either died or were lost before they were properly investigated; 10 of the 13 were lost in the first year. An analysis of the remaining 201 is shown in Table XIX, which gives the stations where these organisms were isolated. With the exception of those for Bangalore, 1929-30, and Poona, 1931, the figures do not represent the total number of isolations of these organisms, but merely the number which were sent to the writer for investigation. Every strain which reached us is included in the 214.

TABLE XIX.—ANALYSIS OF 201 STRAINS.

	Subgroup A				Subgroup B							Sub-group C
	103	P 119	170	Un-classi-fied	88	P 288	P 274	D 1	D 19	B. alkale-scens	Un-classi-fied	Un-classi-fied
Secunderabad, 1928-29	3	—	1	—	5	1	4	7	2	—	—	1
Bangalore, 1929 ..	4	—	5	5	8	—	—	—	—	1	—	6
Bangalore and Poona, 1930	7	—	4	1	6	—	1	—	—	2	1	15
Poona, 1931	17	7	7	2	15	9	2	2	—	2	—	15
Bombay, 1931	—	—	—	—	—	1	—	—	—	—	—	—
Jubbulpore, 1931 ..	1	2	—	1	1	—	—	—	—	—	—	1
Bangalore, 1931 ..	3	2	—	1	2	—	1	—	—	—	—	—
Mhow, 1931	1	—	—	—	—	—	—	—	—	—	—	1
Quetta, 1931	1	—	1	—	1	—	1	—	—	—	—	—
Meerut, 1931	4	—	1	—	—	—	—	—	—	—	—	—
Burma, 1932	—	1	—	—	—	—	—	—	—	—	—	—
Poona, 1932	—	1	—	1	1	2	—	—	—	—	—	—
Total ..	41	13	19	11*	39	13	9	9	2	5	1	39
Percentage (approx.) ..	20·5	6·5	9·5	5·5	19·5	6·5	4·5	4·5	1	2·5	0·5	19·5

* See Table XII.

F. PROPOSED FURTHER INVESTIGATIONS.

The ultimate object of this work is to provide a rapid and reliable method of differentiating between pathogenic and non-pathogenic dysentery organisms.

On the basis of the classification given above, it is proposed to continue amassing data on the various types, and a scheme has been evolved by which all these organisms isolated in the military laboratories in India will be carefully examined, and records of the type of case in which they occurred tabulated. Agglutination tests will be carried out with the patient's serum where possible. It is anticipated that in a few years sufficient experience will have accumulated to enable conclusive opinions to be formed.

Special researches will be conducted by selected laboratories on the "unclassified" strains of Subgroups A and C. It may well be that certain of the strains shown in Table XII are of common occurrence in other parts of India. Also it seems probable that completely new strains may be forthcoming.

Having come to conclusions on the question of pathogenicity, there will be little difficulty in making practical application of the results.

The biochemical reactions will still be used to effect a preliminary classification, suspicious colonies from plates being inoculated into lactose, glucose and mannite, and on to an agar slope. Members of the group under discussion will reveal themselves as non-motile coliform organisms which do not ferment lactose, but produce acid without gas in glucose and mannite.

Further classification by biochemical reactions is impracticable in routine practice, as the changes are too late in occurring.

By agglutination tests, however, immediate results can be secured. The manufacture of polyvalent serum for strains classified as pathogenic is an easy matter, but in view of the number of organisms with little or no antigenic relationship, it will be necessary to split them into two or three groups, and prepare a serum polyvalent for each such group. Using these (stock) sera, and a saline emulsion of the organism from the agar slope, agglutinability can readily be determined, and strains which prove agglutinable would be reported as dysentery bacilli, all others being discarded.

G. Summary.

(1) In India a large number of mannite-fermenting bacilli resembling *B. dysenteriæ* Flexner do not agglutinate with serum polyvalent for V, W, X, Y and Z.

(2) By means of delayed biochemical reactions and serological tests a more detailed classification has been made which embraces the majority of these strains.

(3) Certain tentative opinions regarding pathogenicity are expressed. Some of the new types are believed to be definitely pathogenic, others remain doubtful, and others are probably non-pathogenic.

(4) A scheme has been elaborated by which these organisms will be investigated on a large scale.

H. Acknowledgments.

This research would have been impossible without the loyal co-operation and assistance of the staffs of the District Laboratory, Bangalore, and the Southern Command Laboratory, Poona—Assistant-Surgeon L. C. Smith and Jemadar J. Michael at Bangalore, and at Poona, Assistant-Surgeon G. L. McDermott, Jemadar Narain Singh, and last, but by no means least, Corporal G. L. Williams, R.A.M.C., who tended a troublesome collection of stock cultures, and performed cheerfully innumerable agglutination and absorption tests.

I have also to thank Major C. D. M. Buckley, M.C., R.A.M.C., for confirming certain results, and various other officers, R.A.M.C. and I.M.S., who from time to time have sent me strains.

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FURTHER CONSIDERATIONS ON THE NATURE OF VIRUS AGENTS, WITH REFERENCE TO SOME RECENT WORK.

By H. M. WOODCOCK, D.Sc.Lond.

(*Continued from p.* 269.)

Various Types of Granules.

There is, however, a further point, of great importance in the present connection, upon which I did not happen to lay any stress in my original paper, because the question of the significance of the small granules described of late was not then to the fore. That a granular condition occurs in the case of both the Negri-body and the Guarnieri-body is evident both from Negri's own accounts and also from Calkin's and Tyzzer's accounts [3]. The great mistake was that, owing to ignorance in these early days of the fact that the Romanowsky stains are *not* selective chromatin stains, the workers on them concluded that *these various small granules contained chromatin and represented the reproductive phase of a parasite*! Hence the various names attached to them, such as " elementary bodies." " initial granules." Whereas they are in reality no such thing, but merely represent further or more complete breakdown of either the globin of the hæmoglobin or the nuclear material of leucocytes.

The Kurloff-body itself affords an excellent illustration in support of this condition. As is well known, the inclusions in the spherical mass of altered hæmoglobin have, in this case, a most diversified form. They may appear either as narrow bacillary rods, long, thin, wavy threads, irregular little lumps and grains, or as a mass of small granules (*cf.* figs. 1 and 2 in text, also the other figures given by Ross [16] and Woodcock [17]). In my original paper [17], I stated that no definite sequence of change in the form and appearance of these inclusions had been determined. I did suggest, however, that the larger masses and rods, etc., were perhaps formed by coalescence of the small granules. This suggestion was undoubtedly a mistaken one. In extenuation of it, I may say that I had then the mode of origin of platelet-granules in my mind (where *only* residual granules are formed) and had not at that time studied, for instance, the alteration of the pigment-material in the louse. It is much more probable, on the contrary, that the finely granular condition happens to be either just one form in which the protein (or " globin ") portion is separated from the iron-containing part of the hæmoglobin, or that the granules result from the breaking up of the larger, more definite inclusions, in an older stage of the " body," that is, after it has been included for a longer time in a particular lymphocyte. Which variety of the process occurs depends, no doubt, upon variations in the biochemical and physical

conditions associated with the functioning of the hæmetaboly in the individual cell concerned.

Now, among the pathological conditions, we have, undoubtedly, ***different cases exemplifying these different variations.*** In the case of the Negri-body, it is probable that the characteristic "body," with its well-defined, spherical inclusions is, as a general rule, an early stage, and that the condition of a compact aggregation of granules (Negri and Levaditi, Nicolau and Schoen) is a later stage, resulting from the further comminution into small particles of the protein inclusions. The form of the characteristic "body"

FIG. 1.

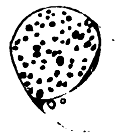

FIG. 2.

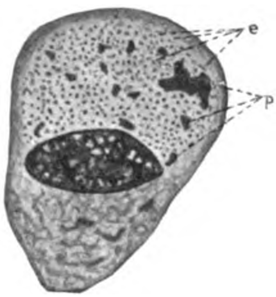

FIG. 3.

FIGS. 1 and 2.—Kurloff-bodies in large lymphocytes.
FIG. 3.—Trachoma-body in epithelial cell.

[*Fig.* 1 *from Woodcock; fig.* 2 *after Ross; fig.* 3 *after Halberstaedter and Prowazek, by permission.*]

above indicated appears to be that most usually observed; and here, it must be noted, the matter is not complicated by an alternative origin of granular material from the breakdown of leucocytic nuclei. Nevertheless, even here, in certain conditions, notably in rabies induced by "fixed" exalted virus, only small, but "hard" and definite-looking little granules are found, which appear scattered. Incidentally, it is impossible to suppose, as do Levaditi, Nicolau and Schoen [9], that the Negri-body is the pansporoblast of a Microsporidian, and that where only the dispersed granules (spores) are found, the parasite has lost the power to produce pansporoblasts; if a species of Microsporidian has pansporoblasts in its life-cycle, it certainly cannot produce spores without them! This just shows the futility of endeavouring to explain an enigmatical "body" upon a parasitic hypothesis, *without a knowledge of the biology of the type of parasite* hypothecated. It must be remembered that, as I showed, the abnormal hæmetaboly may occur extracellularly, and, granted the presence of a powerful "intensified" ferment, its action on the corpuscles extracellularly may explain the scattered distribution of the granules in the cases where they are often seen outside the nerve-cells. (I would refer also to the figure I gave [17, *e*,

fig. 13] of an example of an elongated, typical Negri-body in a narrow segment of a capillary, abutting on two yellow, flattened corpuscles.)

Again, in the case of the Guarnieri-body, where this is formed from alteration of hæmoglobin, we have at first a very similar, well-defined "body," the inclusions in which probably break down subsequently into small granules; thus we get many of the appearances figured by Calkins and Tyzzer (*loc. cit.*). These granules, like the "bodies" themselves, may be, in the case of smallpox, intranuclear, as well as intracytoplasmic. (This is clear from some of the photomicrographs of Councilman, Magrath and Brinckerhoff.) But this intranuclear absorption of hæmoglobin, in response to a powerful exciting stimulus, presents no difficulty of comprehension, when it is remembered, as I have shown, that even normally, in the rapid growth of the mammary-gland epithelium during pregnancy, hæmoglobin is absorbed actually by the nucleus [23]. It is in points like these that the varying mode of working of the *normal* hæmatophagic and hæmetabolic function provides such an invaluable basis for comparison with, and understanding of, these pathological conditions.

I would also take this opportunity of adding a few remarks bearing upon this point, which (*a*) support my interpretation of the Negri-body as altered, ingested hæmoglobin; and (*b*) adduce further evidence in support of the general view that tissue-cells *have* normally a hæmetabolic function. They are the outcome of a recent re-perusal of Acton and Harvey's very instructive paper [1], and are very pertinent to this important question. In the first place, in my paper (*b*, fig. 13, *loc. cit.*), I figured a fairly large Negri-body (probably intracellular) in an early stage of formation, consisting of a polychromatophilic mass, with the fine, superficial granulations just appearing, a small part of which, however, is still unaltered, yellow hæmoglobin. Now, Acton and Harvey describe masses of yellow material occurring in the nerve-cells of both "normal" (i.e., non-rabid) and rabid brains. Unfortunately, they persist in regarding, without any adequate evidence, this substance as derived from the relatively small nucleolus (karyosome). Whereas, it is practically certain that when yellow-coloured material is found in a tissue-cell this is hæmoglobin or some derivative. I have on previous occasions cited numerous examples of this; for instance, in macrophages, in the intestinal cells of the rat-flea (Minchin and Thomson), in those of the ked (Anigstein), of the mites (Reichenow, Woodcock), and of the louse (Woodcock). Further, I have also found hæmoglobin (as well as "foreign" nuclear material) ingested—doubtless, to be utilized—by the eggs of the mite; and there can be little doubt that this is the main source of the material forming the so-called "yolk-nucleus" of many eggs, an example compared by Acton and Harvey in support of their view of the nucleolar origin of the Negri-bodies. The material of the "yolk-nucleus" stains intensely with iron-hæmatoxylin, *because it contains the iron of the ingested hæmoglobin*, and *not* because it is extruded nucleolar matter, which is an entirely erroneous view.

Where leucocytes are ingested the breakdown of the nuclear material gives rise to less well-defined little clumps and small masses, and then ultimately to finer granules; compare, for instance, either cellular autolysis, such as the disintegration of the nuclei of the intestinal cells of the louse, which also results in the production of "Rickettsia" granules, or the digestion of "foreign" nuclear material ingested by macrophages (*vide* the excellent illustrations given by Leishman [8] and Low and Wenyon [10]). In whichever of these ways they ultimately arise, these granules in variola and vaccinia *constitute undoubtedly a large proportion* of the Paschen-granules which have recently caused such excitement.

On the other hand, there are certain instances of the occurrence of "bodies" in virus diseases, in which these have not, at any stage, a well-defined, characteristic "structure," but consist always of a number of more or less compact little lumps and granules, or solely of granules. This condition corresponds closely with the other extreme in the Kurloff-body, that, namely, of a mass of granules. Examples are, trachoma, molluscum contagiosum, and fowl-pox; in the last named the whole "body" or mass of granules has been termed a Bollinger-body, and the individual particles of which it is made up, Borrel-bodies. I have not studied any of these myself, but it is most instructive to compare a figure of Halberstaedter and Prowazek's [15] of a trachoma-inclusion (in an epithelial cell of an experimentally infected orang-outang) with those of a Kurloff-body, also reproduced (figs. 1 and 2, p. 344). Can there be any doubt that, in the former case as in the latter, the granules (*e*, fig. 3) result merely from the further breaking down of the small lumps and larger grains (*p*)? The authors themselves regarded the latter as being of plastin-like material. It is safe to say that nothing of an organismal nature is manifest in this illustration of their's. Just as in the case of the Kurloff-body, so the trachoma-inclusion is an instance of hæmetaboly, in this case of abnormal character. And a similar explanation will be found, I am certain, to apply to the other virus bodies and granules when they have been completely investigated.

It is important to note that where these various granules (as distinct from "bodies") of certain virus diseases have been carefully studied and measured in ordinary stained smears, a much greater range of variation in size is found than might be expected from the restriction of their examination to the smallest ones capable of passing a filter. This has been shown by Coles [2], with the assistance of Merlin. It may be mentioned that the author remarks that the bodies (meaning the granules) are Gram-negative and not easily stained with the customary aniline dyes, thus agreeing with the usual view. He also adds that after Giemsa, they stain practically the same tint as many of the "Rickettsia" bodies. In the case of herpes, the largest grains are as much as 0·83 μ in diameter, while the smallest are only 0·2 μ; and in the case of vaccinia, the largest are also 0·8 μ, and the most minute 0·26 to 0·21μ—the latter size corresponding, it will be seen, fairly closely with those now distinguished as Paschen-granules. But in

both cases Coles has no hesitation in regarding them all as part and parcel of the same thing. There is no sharp separation between the extreme limits of size ; all transitional stages can be met with. From what has been said in the foregoing pages, it will be clear that we have here again examples of the continued comminution or fragmentation of protein particles, down to the smallest limits of the particular substance, perfectly comparable with the manner in which the smallest " Rickettsia " particles are formed (*vide* also above, p. 267). In short, all the so-called multiplication of these "initial granules" and "elementary bodies" must be considered extremely suspect.

These ultimate particles, which have been discussed above, do not, it is hardly necessary to say, themselves *grow* into " bodies " again, when starting a fresh " infection." What happens is that the enzyme adsorbed to such colloidal particles sets up afresh the production of the same abnormal enzyme in the " susceptible " cells, thus causing again the same pathological alteration of the blood-digestion ; just as a minute quantity of " bacteriophage," when added to a particular bacterial culture, will induce the bacteria themselves (in this case, in the course of their own multiplication) to produce more of it, in great amount. A pertinent point has been raised in friendly criticism. It has been asked why, on my view of the production of these bodies and granules by enzyme-activity, are there any solid protein masses or particles left at all, if the ferment is a proteolytic one? Would not the ultimate end-products of the hæmetaboly be relatively simple, soluble compounds, such as peptones or amines? In reply, I would say that I have never called these enzymes proteolytic; I do not know if they should be rightly so termed. I would suggest that the ferments concerned have the power of breaking down highly complex protein material (like hæmoglobin or chromatin with its nucleo-proteins) *only to a certain stage or degree.* Ferments with differing powers of dissociation *are* known to occur; thus, in the ordinary digestive processes, while pepsin converts proteins into proteoses and peptones, another ferment, either trypsin or erepsin, can carry dissociation a stage further into peptides and amino-acids. Similarly, these hæmetabolic enzymes may be capable only of separating the most complicated combinations of molecule-groups into less elaborate ones, e.g., hæmoglobin into hæmatin (or some protein molecule with which is associated the iron) and " globin," or a corresponding, but insoluble protein. Thus the *non*-iron-containing particles ultimately resulting in consequence of the varied physical (and, perhaps, further biochemical) action can *still exist* as solid material, even if, in some cases, almost colloidal in minuteness, and hence can have attached to them a minute quantity of the still invisible and undetected enzyme. That such a persistence of protein particles *can* occur is known from the ordinary facts of cellular autolysis, which is certainly the result of enzyme-activity.

I have laid especial stress on this origin of "elementary bodies" or "initial particles" as end-products of abnormal hæmetaboly because this

gives, almost certainly I consider, *the right clue to the nature of the actual virus.* But I do not mean to infer that *all* the huge quantity of granules which must obviously be present in virus material, as collected and used, either for examination or inoculation, is directly thus formed. Probably in few cases would there be anything like enough "bodies" or masses of granules present to account for such a quantity. The important point is this: Especially in the latter stages of such conditions, *the affected and deranged cells themselves* will more and more tend to undergo lysis by the action of this pathological ferment—i.e., the process will degenerate into a form of autolysis—with their resulting disintegration (particularly of the nuclear material) into many more granules, having adsorbed to them the same enzyme. Further, there is an important modification of the principle thus outlined which, as I think (*vide* [18] and [24]), may be in operation. In the case of certain virus diseases, these may have originated, or may originate at any time (given the necessary conditions) by the separation of a pathogenic ferment (or "toxin") from a micro-organism and *its independent production and further dissemination by cell-metabolism directly.* Here the question may be one, either entirely or partly, in different cases, of cyto-metaboly, or cytolysis, rather than of abnormal hæmetabolic functioning by the cells first of all. Such infections may be expected to have a relatively short incubation-period as compared with the much longer one of typical hæmetabolic virus diseases (*cf.*, for instance, epidemic influenza, on the one hand, with chicken-pox, smallpox and hydrophobia on the other).

Finally, a few words of comment are necessary in regard to a view which has been recently put forward that the virus agents are not essentially intracellular in operation, the penetration of cells being only an "accidental event." I think that everything above detailed indicates just the contrary. Such a view certainly does not apply to the cases, for example, of rabies and poliomyelitis. During the discussion on virus diseases at the recent meeting of the British Medical Association, both Galloway and Fairbrother had some instructive remarks to make bearing upon this point (*vide Lancet*, September 3, 1932, p. 518). From what they said, it is clear that the virus in both these instances has a very elective affinity for the neurones—a fact which has been, indeed, long known in the case of hydrophobia. When the path of tetanus toxin in the body is remembered, does not the parallel behaviour in these cases irresistibly suggest also a toxic principle as the cause? Moreover, no one, let it be remembered, has ever found specific organisms, bodies or granules *at the site of a rabid bite,* for instance! In my opinion, the pathological change in rabies is due to the nerve-cells being no longer able to metabolize ingested red corpuscles in a normal manner, so that a portion of the hæmoglobin containing the iron is set apart in the form of Nissl bodies or substance; the hæmoglobin is merely altered, by the action of the abnormal enzyme, into the form of Negri bodies—entirely comparable with Guarnieri and Kurloff-bodies.

SUMMARY.

To sum up. The above analysis of my view of the nature of these various "bodies" and related granules does not differ in any essential respect from that which I originally outlined in my first papers ten years and more ago. Having ascertained, by careful observation, the nature and mode of origin of certain of these abnormal "bodies" and granules, when I learnt about the bacteriolysin and the explanation of its method of transmission which was suggested to me by Ledingham, *I applied a similar interpretation to the virus diseases* and concluded that the causal agent of such conditions must be *also* a pathogenic enzyme, capable of transmission in a similar manner (*vide* especially [18], p. 256).

Now I have noticed that in one or two cases, e.g., [6] and [13], where reference has been made to this view of the causation of virus diseases by particular ferments, it has been ascribed particularly to a German worker, Doerr. I would point out the following facts: The first similar suggestion or expression of opinion on the part of this author, of which I am aware, was made in a paper by Doerr and Zdansky, when reviewing the state of our knowledge regarding *herpes and encephalitis lethargica*, which was published in April, 1924 (*vide* 22). Doerr and Zdansky based their suggestion, not upon any positive findings of their own (unlike my original view, which was founded upon the definite occurrence of abnormal hæmetaboly), but upon certain experimental work, chiefly biochemical and cytotoxicological, by other German investigators, which they considered afforded a starting point in this direction.

There is, further, one other point which has, throughout, struck me as remarkable. The great majority of bacteriologists freely admit the operation of this principle—that is, of a transmissible lytic agent, not of living nature—in explanation of the case of the bacteriolysin. But, with rare exceptions, they seem most reluctant to admit the operation of a similar principle in the case of virus diseases, where typical cells are affected, and, in consequence, strain against facts and reasonableness in the endeavour to show that a living organism is concerned in such cases. Now this is both illogical and non-biological, because, in both sets of cases, *living protoplasm is concerned*, and the basic attributes and modes of functioning of living matter are universal! Hence, if this remarkable principle does operate in the case of bacteria, there is no reason why it should not do so in the case of tissue-cells.

I would like to refer briefly to one or two of the exceptions mentioned, that is, to writers who have expressed themselves as *not* satisfied that the granules which have recently aroused such enthusiasm are indeed living organisms and the actual causal agents of virus diseases. Rivers, as editor of a general compilation upon this subject of filterable viruses [15A], remarks as follows: "No virus has been obtained in an absolutely pure state. Not even the washed granules of vaccine-virus can be accepted as representing only virus. Therefore it is impossible to say that virus alone is

being filtered rather than virus attached to aggregates of protein or particles of degraded cells." Later on, he says: "It is impossible at present to say whether the viruses are animate or inanimate." Again, Carrel, in his account of tissue-cultures in the same work (*l.c.*), says that "some viruses may be non-living substances manufactured by tissues or blood-cells, and not ultra-microscopic organisms."[1]

The fundamental arguments in favour of my view are these: (1) The undoubted occurrence of abnormal hæmetaboly (and of cytometaboly or cytolysis), *implying the action of an abnormal enzyme*, is the characteristic, diagnostic pathological feature of most of these conditions; (2) *no* living organism—or micro-micro-organism!—has been detected as a causative agent; and (3) if, as seems most probable, the actual virus is something, as yet undetected, adsorbed on to these particles and granules, to whatever degree of minuteness they may become comminuted, the "units" of which this substance is constituted must be so extremely minute that it is, biologically, most unlikely that it can have the properties of living matter.

On the other hand, also from the biological aspect, it is certainly a remarkable and, at first sight, astounding quality of behaviour of living protoplasm that the influence of a particular substance, of enzyme-nature, should induce the cell to produce—with harmful effects upon its own metabolism and, ultimately, on its life—more of this same ferment. There are, however, certain analogous conditions known which may have a bearing upon, or be an indication in favour of, such a mode of behaviour as being possible. One is the action of hormones in causing functional activity on the part of other cells. Where such activity takes the form of secretion, this certainly means that ferment-action is excited in the particular type of cell concerned. It is, of course, by no means a parallel case, because the enzyme whose production is stimulated is a normal enzyme of that particular cell-type and not the same substance (or enzyme?) as the exciting hormone. The other analogy is afforded by certain interesting experiments by Frey [5A], referred to by Doerr and Zdansky, on the contagion, or "infection," of healthy red corpuscles through or by means of others, which have been damaged by being subjected to the action of piperidin or of boiled extracts of organs. In these experiments, direct intervention of the primary toxin or poison was excluded. Frey considers that the primary poison induces the formation of cell-products in the damaged corpuscles, which, in their turn, can affect

[1] According to Rivers, Sanfelice, working with fowl-pox (contagious epithelioma of chickens) in 1914, found that the virus was not inactivated by one per cent caustic soda, and because of this he was led to think of it as an inanimate poison, capable of attacking normal cells and producing within them a poison of a similar nature, which in turn could attack other normal cells. Thus he described his idea of how a lifeless agent might be passed in series reproducing itself indefinitely. Therefore this, of which I was hitherto unaware, seems to have been the first time it was actually suggested that an animal virus disease might be due to a non-living agent (the reference given is *Zs. Hyg.*, 76, 1914, p. 257).

fresh, healthy ones. The great difference in this case is that, although the same toxic substance is apparently produced afresh, red corpuscles, though of highly-organized material, are not themselves any longer living elements. And this is as far as biology can yet take us in regard to this most important and intriguing question.

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THE CAUSE AND MEANS OF PREVENTION OF TONSILLITIS, WITH SPECIAL REFERENCE TO NAVAL AND MILITARY SERVICE.

By TENAX PROPOSITI.

THE rising incidence of tonsillitis throughout the Army has received a great deal of attention during the past few years. This problem is not one which is confined solely to the fighting services and a comparative study of statistics from other large communities is instructive, for it shows that the percentage of cases in the Army is not unusually high.

In an epidemiological and statistical study, Sydenstricker [1] has shown that there has been a gradual increase in the incidence of tonsillitis throughout the world since 1880. Dudley [2] has found the average number of cases per term at the Royal Naval School, Greenwich, to be 4·6 per cent. Glover [3] has recently quoted the figures of the committee of investigation into schools. Among 8,500 public school boys the incidence was 4 per cent per term. Among 3,000 girls under similar conditions it was again 4 per cent. Close [4] gives the percentage of cases in 386,272 out-patients at Guy's Hospital as 6·7 per cent. The last figures have been spread over the period of ten years and the conditions of the local housing will account for the higher incidence; as all ages are included the figure 6·7 per cent is lower than might be anticipated. The figure for the Army at home [5] is again 4 per cent for admissions to hospital, so that it may be assumed that 4 per cent is a remarkably constant figure for the number of cases of tonsillitis in any community.

The title of this paper is the cause and means of prevention of tonsillitis. The cause is dealt with under three headings: the bacteriological, the environmental, and the personal factors. It is difficult to prevent these three headings overlapping as they are all intimately associated. Each is dealt with separately as far as possible.

THE BACTERIOLOGICAL FACTOR IN TONSILLITIS.

This section is divided into two parts. The first deals with streptococci and their presence in the normal tonsil, the second with the relation of streptococci to tonsillitis.

Part I.—Streptococci.

The evidence is growing ever more convincing that the important bacteriological factor in tonsillitis is the hæmolytic streptococcus.

Our knowledge of streptococci is intimately bound up with the history of their classification. The first attempts were based on the ability of the various types of streptococci to ferment a long list of sugars.

Gordon [6] published his classification in 1903. In 1906 he grouped the streptococcal flora of the tonsil as follows:—

Streptococcus pyogenes	.. .. ..	13 variants
,, *salivarius*	.. .. ..	13 ,,
,, *anginosus*	.. .. ..	25 ,,
,, *fæcalis*	.. .. ..	11 ,,
,, *pneumococcus*	.. ..	18 ,,

Holman later used a more rigid classification, but only added further names to the already formidable list. It is becoming more and more difficult to assess the clinical and pathological value of any particular strain.

In 1919 Brown [7] re-introduced an old and discarded classification based on the effect of streptococci on fresh blood in the blood-agar plates. This was an old method of Schotmuller who first described *Streptococcus hæmolyticus* and *Streptococcus viridans*. Brown insisted on a very careful technique and divided the streptococci into four groups. These are the alpha, alpha prime, beta, and gamma strains. As frequent reference will be made to these groups a short description of the action of the four strains on poured blood-agar plates is given. This description is taken from a paper by Knott [8] in the Guy's Hospital Reports.

Alpha Strains.—There is a greenish discoloration and partial hæmolysis of the blood-corpuscles immediately surrounding the colony, forming a rather indefinitely bounded zone one to two millimetres in diameter, outside which is a second, narrow, clearer and not discoloured zone. When these colonies are examined by means of a low-power microscope, many corpuscles, discoloured but not hæmolysed, are seen in the inner zone. Relatively few corpuscles remain in the narrow outer zone. The outer zone increases when, after incubation, the plate is kept in the ice-chest.

Alpha Prime Strains.—A zone of hæmolysis, which is slightly hazy, surrounds the colonies and is less sharply defined than in the case of the true beta hæmolysis. The colony is not very sharply defined and the zone contains moderate numbers of unaltered corpuscles. There is no greenish discoloration. Unlike the beta hæmolysis, considerable extensions of the zones may occur when the plates are kept in the ice-box.

Beta Strains.—The colonies are surrounded by a sharply defined, clear, colourless zone of hæmolysis two to four millimetres in diameter. No corpuscles can be seen within this zone; it develops more quickly than that of the alpha type, often being well-developed after eighteen hours incubation. No increase in the beta zone occurs in the ice-chest.

Gamma Strains.—The colonies develop on the blood-agar without producing any visible change in the medium.

In this classification the old *Str. hæmolyticus* is included in the beta hæmolytic group, and the *Str. viridans* in the alpha group. Amongst the gamma strains are included *Str. fæcalis*, *Str. salivarius*, *Str. mitis*, etc. The important point is that the beta strain is highly pathogenic, the alpha mildly so, while the gamma strains are essentially saprophytic. The

evidence is increasing every day that the only bacteriological factor of real importance in tonsillitis is the beta hæmolytic streptococcus.

Streptococci of the Normal Throat.

It is a matter of every day experience that a great variety of organisms can be recovered from a swab of the normal throat. Davis [9] has found streptococci, staphylococci, pneumococci, meningococci, and diphtheroids. Shipley, Hangar, and Dochez [10] state that the basic flora of the normal throat includes Gram-negative cocci, non-hæmolytic streptococci, large Gram-positive cocci, *Bacillus influenzæ*, and diphtheroids, with a transient flora of *Staphylococcus albus*, hæmolytic streptococci, *Staphylococcus aureus*, *Staphylococcus citreus*, and pneumococci.

The streptococcal flora of the normal tonsil has received a great deal of attention. In 567 persons Tongs [11] found 67 per cent showed the presence of the *Streptococcus hæmolyticus*. Davis [12] has demonstrated that repeated cultures taken from the throats of normal adults at intervals showed the presence of hæmolytic streptococci sooner or later. Arnold [13] finds the presence of hæmolytic streptococci in normal people to vary between 15 and 100 per cent. Walker's [14] work on Army recruits is of interest in that it deals with military conditions. Although streptococcus disease was absent during the investigation, 16 to 20 per cent of recruits showed the presence of a hæmolytic strain. A similar figure was obtained from the permanent personnel. Beattie [15] has found the hæmolytic streptococcus in 92 per cent of tonsillar crypts.

Bloomfield [16] finds two main groups of organisms in the normal throat. The first is constantly present and consists of Gram-negative cocci and non-hæmolytic streptococci. The second is transient and consists of pneumococci and hæmophilic bacteria. In 1921, working on the throats of infants, Bloomfield found a very simple bacterial type consisting of:—

(1) Staphylococci, introduced by feeding and recoverable from the nipple of the nursing mother.

(2) Non-hæmolytic streptococci.

(3) A few Gram-negative cocci and diphtheroids.

Hæmolytic streptococci were never found in infancy. This agrees with the common clinical experience that tonsillitis is most unusual below the age of five years. Close [4] and Layton [17], have both stressed this fact.

The importance of distinguishing the pathogenic beta type from the non-pathogenic alpha types has been pointed out by Bloomfield. In the course of a repeated and very closely controlled study of an epidemic of influenza, a widespread distribution of alpha prime forms was found, but no increase in beta hæmolytic forms. Cases of tonsillitis did not show a rise in incidence. This is in conformity with the experience of the Army [5] during the epidemic of influenza in the Eastern Command in 1928 when the following figures were obtained :—

	1928	1929
Influenza	93·2	10·1
Tonsillitis..	51·4	54·0

The evidence strongly suggests that the hæmolytic streptococcus was absent from the throats in these particular outbreaks of influenza.

Eves and Watson [18] have worked on the throats of 450 school children taken from three schools. The ages varied between 11 and 20. They found the hæmolytic streptococcus to occur in the throats of 58, 75, and 84 per cent respectively in the three groups.

Shipley, Hangar, and Dochez [10] have found a striking increase in the incidence of the hæmolytic streptococcus in the throat during the winter months, when throat infections were most prevalent.

Fox and Stone [20] have shown that the presence of the hæmolytic streptococcus may be frequently unassociated with symptoms in the carrier, but associated with colds, influenza, etc., in other members of the community. In almost every case where pathological conditions were present, the hæmolytic streptococcus was detected. McCartney [21] finds the hæmolytic streptococcus to be abundantly present in acute inflammatory conditions of the throats of children. Thomson and Thomson [22] have made a complete study of the literature and carried out some extensive photographic work. They have found the hæmolytic streptococcus to be of the greatest importance in the cause of tonsillitis, but the presence of the following organisms is also a considerable factor : *Micrococcus catarrhalis, Staphylococcus aureus, Bacillus influenzæ*, pneumococci, and Gram-negative bacilli.

Part II.—Streptococci in Tonsillitis.

The evidence that the hæmolytic streptococcus is the important bacterial factor in tonsillitis is convincing.

Young and Crooks [23] have investigated a large number of throat swabs from acute cases. Hæmolytic streptococci were obtained in 80 per cent of cases which were not diphtheritic in origin.

Bloomfield and Felty [16] and Hodges have carried out a most painstaking and controlled series of experiments on the incidence and spread of tonsillitis amongst 200 nurses of the Johns Hopkins Hospital. Three cultures from each member of the group were made in meat infusion broth and poured on 5 per cent human blood meat infusion agar (pH. 7·4). 28·7 per cent gave a positive growth of the hæmolytic streptococcus. The results of their investigations were :—

(1) That the focus of infection was the tonsil, and that bacteria did not actually grow on the surface of the tonsil except by accident.

(2) That the number of streptococci obtained in the culture bore no relation to the clinical signs.

(3) That in no case of clinical tonsillitis was the hæmolytic streptococcus absent.

(4) That the absence of the hæmolytic streptococcus was strong evidence that the case was either diphtheria or Vincent's angina.

Later, the same authors have produced convincing evidence that tonsillitis is specifically due to the hæmolytic streptococcus. Other streptococci, staphylococci, and pneumococci are present but merely saprophytic. MacCallum puts the blame on to the viridans strain, but Felty and Hodges have shown this organism to be a normal inhabitant of the throat. The hæmolytic streptococcus persists in the crypts long after the acute infection is over. Nakamura [25] has supported this by finding a high incidence of hæmolytic organisms in the crypts of tonsils removed during the winter months.

In their series of cases, Bloomfield and Felty found at least four strains of beta hæmolytic streptococcus to be causative factors, whilst a still greater variety of strains of streptococci occurred as parasites among carriers.

Richey [24] investigated 155 volunteers, using the secretion obtained from the nose in cases of influenza. The secretion was filtered and instilled into the nose; no infection occurred. When crude secretion was used, sixteen of the group developed acute tonsillitis from which a hæmolytic streptococcus was subsequently recovered.

Julianelle [26] has recorded the bacteriology of 147 cases of hypertrophied tonsils in which the hæmolytic streptococcus was found in 90·4 per cent, staphylococci in 62·5 per cent, and *Streptococcus viridans* in 51·2 per cent. Hambrecht and Nuzum [27] examined 218 cases, of which 63 per cent gave a history of repeated sore throats. Pathological changes of the tonsils were present in 93 per cent. Further, 96 per cent of these infected throats showed the presence of streptococci, which predominated in 85 per cent.

In Vienna, Waldapfel [28] has attacked the problem from a different angle. He injected himself with twenty cubic centimetres of defibrinated blood from a patient suffering from acute tonsillitis and also rubbed a smear from the patient's tonsil on to his own throat. Both experiments gave negative results. Waldapfel concludes :—

(1) That tonsillitis cannot be transferred from tonsil to tonsil by inoculation directly, or by the transfusion of blood from a patient to a healthy normal.

(2) That the phagocytic powers of the blood are increased as a result of acute infection.

(3) That this phagocytosis is specific for the particular strain of infecting streptococcus.

(4) That the streptococcus present is not accidental but in close relation to the disease and its course. The factor which precipitates the onset of acute infection is unknown, but is attributed to some febrile condition, such as a cold, which upsets the biological equilibrium of the body.

Polvogt and Crowe [29] have found that throat cultures taken during

the winter months showed 91 per cent of hæmolytic streptococci. Fifty per cent of the cases showing the hæmolytic streptococcus were children under 11 years. The majority of the cases in which the staphylococcus was predominant were over twenty-five years of age. Cobe [30] investigated 400 cultures and found the streptococcus to predominate. Hæmolytic streptococci came second in incidence, followed by pneumococci in order of importance.

Thomson and Thomson [22] have shown that the infecting type of streptococcus does not remain constant, but varies from week to week. They have not found the hæmolytic strains to be very common, but viridans types to be numerous. Gram-negative cocci of the catarrhalis group are always present. From the results of their photographic work, they have not incriminated any one organism, but have suggested that there are a large number of tonsillar infections in which various types of streptococci play the most important ætiological role. Other bacteria such as *Micrococcus catarrhalis, Staphylococcus aureus, Bacillus influenzæ,* pneumococci, and Gram-negative bacilli of the colon group are also incriminated. In this series, the pus from the yellow pin-point abscesses of follicular tonsillitis has seldom yielded a growth of hæmolytic streptococci. A green-producing organism of the viridans type has been suggested as probably the most important causative bacterial factor. This work has been done with such a wealth of photographic detail that considerable doubt seemed to be cast on the importance of the hæmolytic types, but the recent paper of Glover and Griffiths seems to have put the issue beyond doubt. These authors have obtained a growth of hæmolytic streptococci in abundance, sometimes almost a pure culture, from every case of acute tonsillitis. Working on material from schools, they have found the result of infection to depend on the size of the infecting dose, the state of immunity of the patient, and the pathogenicity of the infecting strain.

It may be concluded from the figures already given that the important bacteriological factor in acute tonsillitis is the hæmolytic streptococcus.

The Army Medical Services [5] have done a great deal of work on tonsillitis from the pathological standpoint, but the results have been disappointing. Vaccines have not proved to be a success and no causal organism has been identified. It seems probable that the weak link in the chain lies in the technique of taking the throat swabs. Some workers have evolved a most rigid technique to obtain successful results. Salivary contamination makes any further work valueless. The most satisfactory results have always been obtained when the bacteriologist takes the swabs himself. It seems probable that medical officers do not appreciate that a good light, a tongue depressor, and great care are essential to ensure that salivary contamination does not spoil the specimen for further examination. Of such importance is this technique that some workers have resorted to tonsillar puncture in order to avoid contamination. A haphazard wipe in the dark is worse than useless. After a careful study of the literature, I am convinced that this is the cause of unsatisfactory results in the past.

The Environmental Factor.

That adequate spacing of beds is necessary for the prevention of the spread of saliva-borne disease has been recognized for many years. The work of Glover on the spread of cerebrospinal meningitis has put this practical knowledge on a scientific basis. Glover [31] showed that a distance of two and a half feet between beds was sufficient to prevent the dissemination of meningococci during eight hours' sleep. Dudley [2] has carried out very careful work at the Royal Naval School, Greenwich. He has found infection to take place only over very short distances, although micro-organisms may travel over thirty feet from the source of infection by droplet spread. The smaller the room, the greater is the likelihood of infection. If the concentration of organisms is small, infection does not take place.

Dudley has explained that in droplet infection by talking, coughing, and sneezing there are two separate and important factors. The particles projected by a cough consist of two types, heavy and light. A cough produces a jet which travels almost instantaneously for a distance of one to two feet, when the resistance of the air stops it. The heavy particles rapidly fall to the ground. The light particles remain floating about in the air for a long time, up to perhaps half an hour. It is the heavy, saliva-carrying, short range jet of heavy droplets which is the important infecting factor.

Professor Bulloch used a suspension of *Bacillus prodigiosus*. In a series of experiments, he was able to recover the same organism from a subject forty feet away from the source.

Some organisms are recoverable from the light air-borne particles. If the heavy, short-range jet of particles is the important factor, although organisms may be recovered from the lighter droplets, what are the factors which determine that infection is transmitted by the former method almost exclusively? To explain this difference Dudley has introduced two other factors, a time factor and the theory of the minimum infective dose.

As regards the first, infection does not take place during the short period of contact at drill or in the dining hall, but during the more prolonged and intimate association in the dormitory. It is possible to travel for perhaps half an hour a day in company with a carrier without becoming infected, whilst contact during three hours in the theatre will allow sufficient contact for infection to occur. This is the hypothetical case given as an example.

The theory of the minimum infective dose has been evolved to explain the different possibilities of infection. A certain mass of infecting agent is necessary to produce an illness, and this mass is received by an individual at various rates. The individual can destroy the infecting agent at a certain rate, and the power of the recipient to destroy the amount of the infecting agent may be positive or negative. If negative, illness will supervene provided that the subject of infection stays long enough near to the source of infection. The greater the negative difference, the less is the time

required to produce a case or a carrier. The difference between the rate of reception and destruction of micro-organisms is termed the velocity of infection. This theory seems to explain why there is such difference of opinion between authorities as to the value of droplet infection in the spread of the saliva-borne disease. If droplet infection is taken to mean only the heavy particle method of spread, there will be general agreement that very close contact is necessary to produce infection.

Bloomfield and Felty [16] have found the spread of tonsillitis to depend on extremely close and prolonged contact. This intimate contact was found to occur in nurses in small dormitories during off-duty hours. The nurses would gather in small groups for several hours, talking, coughing and eating.

Flugges' experiments with suspensions of *Bacillus prodigiosus* showed that few, or no, bacteria left the mouth during quiet talking, but that vigorous coughing expelled them for varying distances up to nine metres, depending on the local conditions. Bloomfield and Felty have repeated these experiments, and have gone further by swabbing the organism on to the pharynx and tonsil, instead of the lips and anterior part of the tongue. They have shown that when infectious material was carefully placed on the tonsil, the most violent coughing and sneezing failed to expel more than an occasional organism. Organisms on the tonsil gradually become transferred to the anterior part of the tongue during the ordinary movements of deglutition. Such a transference was shown to take place only rarely. A further investigation to attempt to recover the infecting organism from the air surrounding the patient was unsuccessful. They concluded that very close contact was necessary to allow the spread of infection from carrier to contact.

It is most difficult to trace the path of direct infection from case to case. I have gone carefully into all recent cases occurring amongst troops and families, and have been able to trace the infection in only three cases. In all of these there was direct evidence of close and prolonged contact. In one case the two children slept in the same bed. In another, both of an engaged couple acquired acute tonsillitis, the girl subsequently proving to be a carrier. In the third case, a mother infected two children so severely that a baby, aged 14 months, died of streptococcal septicæmia and a boy, aged 7 years, was severely ill with a spreading inflammation of the throat, and very narrowly escaped tracheotomy. The mother was subsequently shown to be a carrier of the hæmolytic streptococcus. In no other cases have I been able to trace infection.

Having established that close and prolonged contact is necessary for the spread of acute tonsillitis, what are the factors which influence such contact so far as the soldier is concerned? These factors have been grouped under the following sub-heads: climate, epidemics, season, temperature, humidity, weather, rainfall, housing, habits, smells, messing arrangements.

(1) *Climate.*—It has been the custom to assume that tonsillar infections abroad are due to dust-borne infection, and at home to droplet infection in

the barrack room. That the dust-laden air of the East is heavily infected is beyond question, but it would appear that the carrier-rate is still more important. The North China area has seasons when dust storms are frequent. These storms are of sufficient intensity to cause "Tientsin throat," but this is a dry pharyngitis and not true follicular tonsillitis. After careful study of the climatic conditions and the incidence of tonsillitis at home and abroad, it would appear that there is no close connection between the climate and tonsillitis. The carrier-rate still seems to be a more important factor.

(2) *Epidemics.*—True epidemic tonsillitis is always milk-borne. Many examples have been given in the literature from all parts of the world. Control of the milk supply has always been followed by a rapid subsidence of the epidemic. Such epidemics do not affect the ordinary incidence of tonsillitis, but they are apt to be severe while they last. It is unlikely that the infection of the ordinary case is milk-borne.

(3) *Season.*—Sydenstricker's [1] extensive paper has shown that the seasonal incidence of tonsillitis throughout the world is remarkably constant. With one exception, there is close agreement on this point. Clifford Allbutt [32] writes that most cases occur in the middle of the summer, but there are no figures to support this statement. Close finds the peak of the monthly graph to be in October; Polvogt and Crowe [29] find it in the autumn. Hodges shows the monthly curve to show a gradual rise in October, remaining high through November, December, January, February, and March, with a fall in April. In North China, exactly the same curve is obtained, although the dust storms occur essentially in February and March. This fact suggests that the carrier problem is of greater æ iological importance than dust-borne infection.

(4) *Temperature.*—Hodges has observed the variations in the daily mean temperature for a period of seven months, but has failed to show any relation to the incidence of tonsillitis. Close could find no connection between the monthly mean temperature or the daily variation in his series. North China has unusual climatic conditions; there is a hot summer and an intensely cold winter. The winter lasts for three months, during which period the daily temperature remains below zero frequently for days on end. The temperature in July and August may rise to 110° F. Very few cases occur during the hot months among the troops left in the cities of Tientsin and Peking. The cold months also do not show a high incidence of cases. There has been a steady fall in tonsillitis during the past five years. The hospital records do not go back for more than five years, but the explanation of the marked fall is probably due to improvements in the housing. This factor is dealt with later. The more the figures are studied the more they suggest that temperature has little effect on the incidence of tonsillar infection.

(5) *Humidity.*—Neither Hodges nor Close has found any connection between the relative humidity and tonsillitis. The air of North China

is intensely dry, and cases of dry pharyngitis are common. This is partly due to the central heating which is universal and essential for reasonable comfort, and partly to the intensely dry air. True tonsillitis is not unduly common.

(6) *Weather.*—The majority of textbooks state that exposure to cold and wet is important, but this has not been brought out in statistics. Hodges has demonstrated that there is no relation between tonsillitis and changes in the weather or exposure to wet and cold. Beveridge [33] has pointed out that tonsillitis was not a common cause of sickness in the front line trenches of France, where exposure to cold, wet and damp were frequent and unavoidable.

(7) *Rainfall.*—Hodges finds no relationship between tonsillar infections and the rainfall. The figures of Close suggest that the number of cases taken over monthly periods varies inversely with the rainfall. When the rainfall is high, tonsillitis is comparatively low. Further, there is no doubt that the Western Command at home always shows the lowest incidence of tonsillitis. The average rainfall of the west coast varies between forty to sixty inches per annum; that of the eastern area of England is thirty inches. Rain in North China is a rarity and of only very short duration, so that any conclusions are valueless; but most of the rain comes in August, when a monthly graph shows tonsillitis to be almost non-existent.

(8) *Housing.*—Something has already been said on this aspect of the spread of infection. In 1924, an investigation carried out in Scotland showed that the incidence of tonsillitis among troops in old barracks was greater than that in new, other factors being equal. It was hoped that rebuilding, decorating, and spacing in barrack rooms would be followed by a corresponding subsidence of cases. Unfortunately, this has not been the case, and we must look elsewhere for the cause.

That satisfactory housing is of importance has been shown beyond doubt during the past few years in Tientsin. In 1927 a second battalion was sent to the area during the disturbances of that year. The new battalion was housed in converted warehouses of the most unsatisfactory type as no other accommodation was available. These warehouses, or godowns, were overcrowded and overheated. There were no recreational facilities or conveniences. Each new battalion, as it arrived, spent one year in the godowns. It was then moved to the permanent, brick-built, British infantry barracks on the departure of the previous battalion which had completed the two-year tour in Tientsin. Each new arrival had a large number of cases of saliva-borne disease. During seven months in 1927, the Border Regiment had 44 cases in the godowns; the East Yorkshire regiment in the permanent barracks had 12. Later, the Royal Scots had 71 cases during their stay in the godown, and 43 for their year in the barracks. As a final example, the 93rd Highlanders spent four months in the godown before the garrison was reduced to the normal size

and the second battalion evacuated. During this time they had 69 cases of saliva-borne disease, whilst the Royal Scots in the permanent barracks had 23 cases.

The messing arrangements, institutes and facilities for sport and recreation were all most unsatisfactory.

Glover [3] has recently pointed out that the incidence of tonsillitis in public schools is becoming a serious problem. This incidence is probably due to overcrowding of the dormitories consequent upon the increased demand for this class of education. The figures of the committee of investigation have already been quoted.

Bloomfield and Felty [16] have found the cause of the spread in their series of cases among the nursing staff of the Johns Hopkins Hospital to be due to intense overcrowding in small dormitories during the winter months. When off duty the nurses would gather together and sit for hours talking, laughing and eating. Prolonged contact was the rule. With the advent of the warm summer season, overcrowding ceased and tonsillitis gradually faded away. Bloomfield and Felty have also found, as Dudley [34] has pointed out, that contact during assemblies in wards and in dining halls is insufficient to cause infection. Both Dudley and Glover [3] have stressed the fact that the incidence of tonsillitis is far higher among boarders than day boys. This fact suggests very strongly that infection occurs in the dormitory.

(9) *Habits.*—Habits are difficult to assess. There is a common tendency in any herd or community to forgather for warmth and company. It is under such conditions that infection occurs. The theatre and the cinema provide excellent conditions for close and prolonged contact. There is no doubt that the cinema has become increasingly popular among troops during the past decade. The talking film is practically as good as a theatre, and many men go regularly once or twice a week. The air of the cinema has been shown to be grossly contaminated, and the warm, moist atmosphere combined with remarkably close contact is more than enough to allow infection to occur. I believe that a greater percentage of men visit the cinema regularly in the London District than in any other Command. The films are newer and more skilfully advertised than elsewhere. Further, the cinema is a form of amusement which the soldier can afford. This would seem to be the reason for the high incidence of tonsillar infections in the Eastern Command. It is unlikely that any decrease will be noted in that Command. In fact, it seems that a further rise may occur owing to the improvement in the production of films.

Swimming baths have always been blamed as a source of infection. That a tank may be a suitable medium for infection to occur is apparent. The picture of an infected swimmer leaving a trail of organisms behind him is attractive to visualize, and most authorities agree that infection commonly takes place in such conditions. In Peking, a plunge bath was erected for the 200 men of the Legation Guard. Many of the men practically

lived in the bath during July and August. The water could not be changed more often than once a week, and the conditions were ideal for throat infections to spread. Tonsillitis, however, was not common. There were many cases of inflammation of the external auditory canal. Some men complained of slight soreness of the throat, but this was probably due to over-chlorination of the water on one or two occasions. Although an infected swimmer must leave organisms behind him, it seems likely that the theory of the minimum infective dose applies in this case, not enough material being received by the potential case to allow clinical signs to appear. Even in a small bath organisms must be in a very dilute suspension.

In 1924, Smiley [35] investigated the effect of the following factors in the prevention, or encouragement, of infection in young students : tobacco, dust, gas, mouth-breathing, sleep, draughts, constipation, perspiration, bathing, and foot-wear. None of these factors seemed to influence the incidence of infection. Cigarette smoking has been blamed in the past for an increase in tonsillitis, but there is no evidence that such a contention has any scientific basis.

(10) *Smells.*—There is a time-honoured statement in many textbooks, supported by popular opinion, that the close proximity of a persistently bad smell has a bearing on tonsillitis. Thomson and Thomson [22] have recently stated that while there is no known method of measuring a smell, yet there does seem to be some basis for the assumption that there is such a connection. In Tientsin, there is one particularly foul creek running through part of the British Concession which has been blamed for cases of tonsillitis in the neighbourhood for many years.

(11) *Messing Arrangements.*—The recent paper of Cumming [36] on the spread and control of saliva-borne disease has created a great deal of comment and interest. The main contention of the paper is that inadequate sterilization of mess-kits is responsible for the spread of disease, especially influenza. Nichols [49] has already carried out some work on this aspect of the subject. He found that the hæmolytic streptococcus was not spread by dish-water as long as the reaction of the water remained about pH 8·5, and the soap was adequate. Cumming has emphasized that the problem must be attacked by blocking the transmission from carrier to susceptible. An extensive series of figures showed that the incidence of influenza among troops who washed their mess-kit by the usual lukewarm method was five times as great as the incidence among those who employed collective efficient sterilization. One group used water at 70-100° F. and the other lukewarm water. The ratio of cases of influenza was as 1 : 6·2, eighty-five per cent of the cases occurring among the unprotected group.

Cumming has given the five-link chain of infection as :—

	Hands		Hands	
Oral cavity of carrier		Mess-kit wash-water		Oral cavity of susceptible
	Mess-kit		Mess-kit	

Organisms were found in the various stages of the chain as follows :—

Oral cavity of carrier 53 %	Hands 33 %	Mess-kit wash-water 66 %	Hands 45 %	Oral cavity of susceptible 34 %
	Mess-kit 16 %		Mess-kit 72 %	

These figures were obtained from a control group using suspensions of *Bacillus prodigiosus*.

Turning to civilian conditions, it was found that among 17,000 people using machine-washed dishes the incidence of influenza was 20 cases per 1,000. Among 4,175 who used hand-washing, the rate was 103 per 1,000. There is strong evidence that tuberculosis is spread by infected table-ware.

The use of boiling water for sterilization was shown to reduce the number of organisms by 99·98 per cent. Seventy-eight per cent of organisms were removed from spoons by hand-washing, and 99 per cent by machine-washing. Further, of thirty-two specimens of wash-water, using the hand method, 84 per cent showed *Streptococcus hæmolyticus*, and 65 per cent *Streptococcus viridans*.

Thirty-eight per cent of cultures from the hands of carriers and cases gave a positive growth, 340 examinations being made.

Cumming quotes Floyd and Fotheringham, who stated that " the belief is constantly growing that tuberculosis, and probably all so-called air-borne diseases are, in the majority of cases, hand-to-mouth or ingestion infections.

These investigations have created a great deal of interest. Thompson [37], at Aldershot, has come to the following conclusions : (1) That there appears to be a definite relationship between efficient sterilization of mess-kits and a low rate of influenza ; (2) that contamination of the wash-water is of considerable importance ; (3) that " pinking " of the water is valueless.

The British soldier has his own knife, fork, spoon and mug, which he retains and cleanses himself. The plate is usually the property of the mess. In canteens, where common property is used, it is not easy to get the staff to carry out the necessary sterilization owing to the difficulty of obtaining an adequate supply of hot water, the want of co-operation, and the danger of cracking the glasses. Unless there is constant supervision, preventive measures are scamped, and are regarded as an unnecessary precaution on the part of the medical authorities. Apart from what can be done in the canteen, it must be appreciated that the amount of eating and drinking which goes on in the small café and bar outside the barracks is probably far greater than that in the N.A.A.F.I. Any good preventive measures taken in barracks are usually rendered valueless owing to this fact.

That the substitution of mechanical sterilization for the present method would have a beneficial effect on the spread of saliva-borne disease is beyond question. All eating and drinking utensils would have to become the property of the mess. Unfortunately, the present financial crisis will not allow such costly methods of installation. Further, unless mechanical sterilization is carried out in the surrounding area, any good effect is going to be largely balanced by infection outside barracks.

(*To be continued.*)

Editorial.

BRITISH EMPIRE CANCER CAMPAIGN.

THE Grand Council record in their Ninth Annual Report that in spite of the difficult and distressing times the work of research into the causes and treatment of cancer continues with unabated enthusiasm. The Campaign plays a great part in co-ordinating the work of researchers and is the foundation of the effort which the British people are making to elucidate the greatest problem of all the mysteries of disease. It also serves as a link between the work at home and the work in the Dominions and foreign countries. The Council state that cancer manifests differences of incidence and even of character in different regions, and not the least of the Council's services has been the emphasis it has placed on the need for the widest field of work and for the broadest possible outlook upon that field.

The nature of cancer still remains a subject of controversy; no final answer has yet been given to the question, what is cancer? and the theories of a few years ago are now under suspicion. In view of the discoveries of Pasteur and Lister the infective theory of cancer had a long lease of life and still has many supporters. But no germ has yet been discovered and there is little evidence of the transmission of cancer from person to person. The discovery of the influence of the accessory food factors on health and disease raised the question whether grave errors in diet might be capable of producing cancer; but up to the present this line of research has offered no solution of this problem. While diseases of definite microbic origin have yielded to recent improvements in hygiene and sanitation, the mortality of cancer has increased.

The Council state that the trend of modern opinion is steadily changing towards a biological view of the nature and origin of cancer. During the year under review, Mr. Lockhart-Mummery has published a biological theory of tumours which is based on the gene mutation in somatic cells.

It is pointed out that tumour cells are normal cells which are behaving abnormally, and it is the behaviour of the cell and not its apparent structure that differentiates it from the normal cell from which it arose. Every cell in the body is subject to some control as regards its behaviour, and the chief controlling influence is situated in the cell itself and is inherited from the germ cells from which it originally arose. The individual cell is influenced by environment, its nourishment and many other factors, but the way in which it will respond to these influences is determined by the genes which it inherited from its ancestors. When a cell, or group of cells, is found to behave in a different manner from its neighbours in the same area, it is

considered that some change must have taken place in the nucleus of the cell.

It is generally recognized that the fertilized germ cell in the case of man will contain in its nucleus a complete double set of twenty-four chromosomes, and a complete set of genes from both its original parent cells, and that these genes control the fate of the daughter cells, viz., determine whether they will become muscle cells, bone cells, nerve cells, epithelial cells, or connective-tissue cells. If this be true of the germ cells, Mr. Lockhart-Mummery considers it must be true of the somatic cells. When a change occurs in the genes of a germ cell as a result of external influences, the change is called a mutation, and the genes will continue to breed true to the mutation which they have undergone. A similar mutation is believed to occur in the somatic cell. Any agent that produces a gene mutation in a somatic cell may cause a tumour if the mutation affects the genes so as to increase the normal rate of mitosis.

From the study of genetics it is known that gene mutation can be produced in many ways, and gene mutations are thought to be one of the chief causes of the variation in species. If it is certain that gene mutation can be produced in many ways, and if tumour formation is due to the mutation of somatic cells, then we can understand why such diverse agents have carcinogenetic properties.

This theory of tumour genesis is considered to explain why tumours grow by the division of their cells and not by converting the neighbouring cells with which they are in contact into tumour cells. The specific character of tumours is also readily understood, as a gene mutation must breed true to the mutation so long as genetic life exists.

Though many people had for a long time thought that the explanation of tumour formation was found in the biology of the normal tissue cell, it was not until the Cancer Conference held in London in 1928 that the possibility of a mutation of the nucleus of the somatic cell was considered seriously. It was suggested by Loeb, Teutschlaender, Strong and Mavor, but no definite theory was propounded. Some years ago, Theodor Boveri suggested that cancer was due to abnormal mitosis—tetrapolar mitosis—of the cell nucleus resulting in an abnormal number of chromosomes. This theory was not generally accepted as the tumour cell must, according to it, have the wrong number of chromosomes, and there is considerable evidence that the nucleus of a tumour cell contains the correct number of chromosomes and that tetrapolar mitosis is uncommon in tumour cells. The whole subject is thought to have been confused by the fact that tumour cells are often found with all sorts of abnormal nuclear structure, but it is considered that there is every reason for believing that the ordinary tumour cell is quite normal as regards its chromosomes, and that gene mutation and not multipolar mitosis is the primary factor in tumour genesis.

Research has shown that 1 : 2 : 5 : 6 dibenzanthracene is the most potent

cancer-producing substance so far encountered. Subcutaneous injections of this substance in lard have caused spindle-celled sarcomata in 31 out of a total of 93 mice and in 15 out of a total of 67 rats. These tumours are true sarcomata and can be passed on by grafting into other mice or rats. Metastases have not yet been found in mice, but in rats metastases have been present in the peritoneum and in the axillary glands. Four different grafted strains of these tumours have been obtained, which have reached the 18th and 29th grafted generations in mice and the 15th and 18th generations in rats, so there is no doubt about their continued growth. The tumours in rats are considered to be particularly interesting, as workers had failed to evoke tumours in these animals until Watson showed that tar cancer could be produced in them if the skin were first treated with a fatty medium. The advantage of injecting the carcinogenic substance dissolved in fat is that the dosage can be more accurately controlled than when the substance is applied to the skin by painting, and the study of anti-cancer producing substances is facilitated. A number of control experiments on the effects of fats and oils alone are in progress, but the part played by the fatty medium cannot yet be exactly defined.

Some time ago it was noted that mustard gas had the power of retarding the production of cancer by carcinogenic agents. It has now been established that 0·05 per cent solution of mustard gas in liquid paraffin applied to the skin of mice which were being treated with dibenzanthracene entirely prevented the appearance of tumours. As the mustard gas was applied on a different day from the treatment with the dibenzanthracene the possibility of the two substances interacting can be excluded. It is therefore suggested that the mustard gas exerts a biological action on the body cells so that the carcinogenic action of the dibenzanthracene is counteracted. The controls, with one exception, which had not been treated all developed cancer, but in not one of the treated animals was there the appearance of a tumour.

The relation of creatine and phosphorus compounds to cancer is being investigated. Creatine has been found almost solely in the vertebrates, and as the ordinary forms of malignant tumour appear to be limited to vertebrates it was thought that the occurrence of creatine might have some relation to malignant disease. Dr. Boyland has estimated colorimetrically the amount of creatine present in human tumours, in spontaneous mammary tumours of the mouse, and in grafted sarcomata in the rat. It was present in all human tumours in amounts varying from 11 to 104 mg. in 100 g. The tumours in the rat and mouse contained amounts varying from 30 to 60 mg. in 100 g. These amounts are greater than those occurring in any normal tissue except voluntary muscle, heart muscle and testes. The creatine of tumours may therefore be of significance.

Further investigations have been made into the relationship of occupation to cancer. Inquiries made as to the relation of length of service to the incidence of mule spinner's cancer has shown that the liability to scrotal

cancer increases with length of service. Men employed for fifty years were found to be five hundred times as liable to develop cancer as those recently employed. It would be interesting to ascertain the incidence of scrotal cancer in the general population. As cancer is more likely to develop after fifty than before, it is considered probable that the curve of incidence in all men would be similar to that in mule spinners, but on a lower plane.

Cancer of the lung has also been studied, and it was found that of 898 cases of primary cancer of the lung the majority occurred in the labouring class ; but no one type of labour was specially concerned. People engaged in dusty occupations seemed to be more liable to develop cancer of the lung than people in other forms of labour.

The treatment of cancer by anticancer sera is still being investigated by Dr. Thomas Lumsden, who is now Director of the Cancer Research Laboratory at the London Hospital.

In previous reports Lumsden demonstrated that anticancer sera can be produced which are specifically lethal to cancer cells cultivated outside the body, but are harmless to cultures of the normal tissues. Unfortunately, he found it was impossible to cure cancerous animals except under very special conditions, because the dose of serum large enough to destroy the cancer seriously injured the animal. But last year he discovered that the anticancerous elements are contained in the euglobulin fraction of the serum and by rejecting the useless and toxic parts of the serum it is now possible to give in this form (euglobulin) about ten times as large a dose of cancer-destroying substance as was previously possible. Accordingly, the year under report has been spent in testing the curative power of this concentrated antiserum upon the spontaneous cancers of mice, i.e., malignant tumours which arise in mice just as cancer arises in man. The cancerous mice have been obtained by breeding from the Loeb-Lathrop-Simpson strain supplied by Dr. Burton Simpson of Buffalo, U.S.A., and from mouse breeders in the South of England as the result of an appeal made by the British Empire Cancer Campaign. Two anticancer sera have been investigated ; one the serum of a sheep inoculated with sterile human cancer fragments, and the other the serum of a sheep immunized against rat sarcoma and mouse sarcoma. The euglobulin was freshly prepared each time, as the anticancer substance soon loses its power when kept.

Dr. Lumsden had found in his previous experiments while treating tumours implanted on mice that injections of the antiserum into the tumour were more effective than injections into the general circulation of the mouse ; the former method was therefore employed in the experiments on spontaneously occurring cancers. At first disappointing results were obtained, as many of the mice which had been injected with antiserum died from the absorption of the disintegrated products. It was therefore

necessary to remove the tumour surgically after it had been injected. Portions of the injected tumour were still found to be active, and this fact made it possible to test whether the treated mice had been rendered immune or not. It had long been known that in an untreated animal a portion of a spontaneous cancer implanted on another area of the animal's body would grow progressively. Accordingly, fragments of the still active parts of the treated tumour were implanted on other parts of the body of the treated animal, and if the fragments (autoplasts) did not grow it was obvious that the animal had acquired immunity and was able to destroy the cancer fragments.

Dr. Lumsden found that of 47 mice suffering from spontaneous cancer, 34 (74 per cent) were cured by inoculating concentrated serum into the tumours; of 40 cancerous mice treated as controls by inoculating concentrated *normal* serum not one was cured; all died of cancer. In 90 per cent of the cured mice it was possible to show that the mice had been rendered immune to cancer as the result of the treatment.

It is hoped that an equal degree of success may be obtained in the treatment of human cancer, but there are many difficulties in the way before such results can be obtained. There is much still to be learned in regard to the technique, dosage, etc., most suitable in human subjects; at present only late or otherwise hopeless cases can be dealt with, since it is considered unjustifiable to delay surgical treatment in the present state of our knowledge of the serum treatment. For the next year or two only selected cases under constant observation in hospitals and institutions can be treated in this way, and at their own request.

The results of a series of experiments on immunity to transplanted tumours in mice indicate that the immunity produced against tumours does not confer immunity against all tumours, but only against the particular tumour which is the subject of the experiment.

In two previous reports reference was made to some experiments designed to demonstrate the presence or otherwise of a genetic factor in the experimental induction of cancer. This question of heredity has a practical bearing on the problem of industrial cancer in man. Many workers employed in trades which give rise to cancer escape the disease altogether, and the question arises whether this freedom is the result of a real immunity to the disease and whether the immunity is transmissible. It has been found that by interbreeding mice which tend to develop tar warts early, a stock can be obtained which develop warts much earlier than the ordinary stock-bred mice. These results are interesting, but they might be due to the transmission of some natural character quite unrelated to cancer. It might be that the skins of the mice in these experiments were more fatty than normal, and that this character was exaggerated by breeding. The subject requires much further investigation.

A large part of the Report deals with the results of the treatment by

radium of cancer of the cervix uteri, breast, tongue, pharynx, and rectum. The observations extend over three years, and it is now possible to determine the percentage of patients suffering from cancer in these regions who have been cured. The results are stated to be disappointing; the number of persons cured on a "three years basis" is not as great as was hoped would be the case. The technique of radium treatment is, however, steadily improving, and there are indications that the percentage of cures is tending to increase as refinements in the methods of applying radium are introduced and as knowledge grows.

Clinical and other Notes.

FRACTURE OF THE ODONTOID PROCESS OF THE AXIS.

By Major C. B. C. Anderson,
Royal Army Medical Corps.

An example of this rather unusual injury has recently come to my notice, and is of sufficient interest to merit being placed on record.

The history of the case is as follows: The patient, a young healthy N.C.O., was involved in a motor accident about three weeks before I first saw him. The car had overturned and he had been thrown out on to the road. He was not sure which part of his body first hit the ground. He stated that he did not feel concussed, and was able to walk a mile to the nearest telephone very soon after the accident. He returned to his camp by bus, and reported sick the same evening, complaining of "a very stiff neck" and pain at the back of the neck. The medical officer's note on his condition that day stated: "Pupils sluggish, headache, severe pain behind ears and neck, nodding and side to side movements very limited and painful. Reflexes, knee-jerks, Babinski, etc., normal. No sensory disturbance." Patient was sent to the nearest hospital where X-ray apparatus was available. He was kept there for seven days. The radiograms taken did not reveal any fracture. He returned for treatment at the M.I. Room, where he attended for massage. A few days before he was sent to me, he noticed "grating" when he moved his head, and his M.O. confirmed this by auscultation. The patient was referred to me for further investigation, and I was able to make the following observations on his condition.

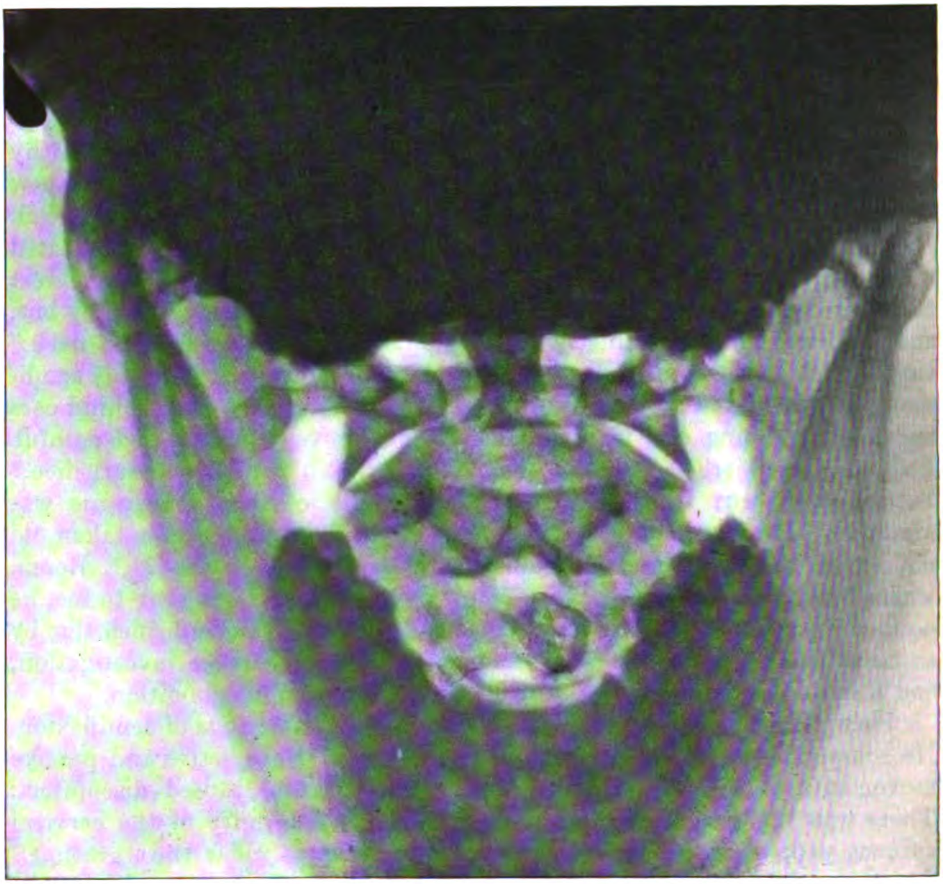
He walked in to see me with his head held in an attitude of semiflexion. He complained of stiffness and pain in the neck. Both active and passive movements of the head and neck were limited and caused discomfort. There was no special area of tenderness. No deformity of the cervical spinous processes was observed. I was not able to elicit the "grating" which had previously been reported. Palpation of the posterior pharyngeal wall did not reveal any definite tenderness or alteration in outline. Symptoms and signs referable to the nervous system were conspicuous by their absence.

Radiograms were taken. In the antero-posterior view taken through the mouth, a fracture across the base of the odontoid process was distinctly seen. The lateral view did not not show the fracture, and the atlas and axis appear to be intact.

Treatment has consisted in immobilization of the head and neck in plaster. No sign of spinal cord involvement has developed.

Reference to literature on the subject of injuries of the atlas and axis

shows that fracture of the odontoid process may occur alone, or in association with fracture of other parts of the axis, or with fracture or dislocation of the atlas. The commonest site at which the fracture of the odontoid occurs is through the neck of the process close to its junction with the body of the axis. It may also occur through the tip of the process, or the line of fracture may include a portion of the body of the axis.

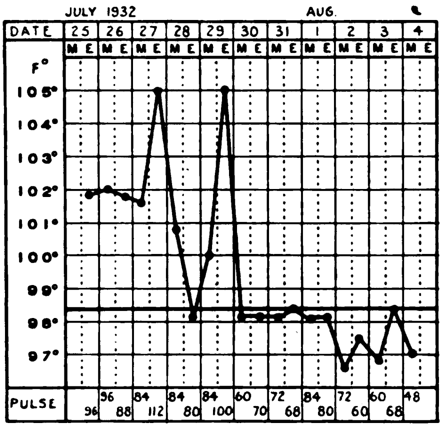


In a fairly high percentage of cases spinal cord symptoms are absent altogether, and this fact may lead to a certain number of cases being overlooked. This applies especially to cases in which the fracture involves only the odontoid process while the axis and atlas escape injury. Injuries in this region are not always fatal, and though spinal cord symptoms may be absent in the initial stages, they may arise later.

A CASE OF MALARIA CONTRACTED IN ENGLAND.

By Major ALEXANDER HOOD,
Royal Army Medical Corps.

GUNNER H. G., aged 22, total service two years, was admitted to the Cambridge Hospital, Aldershot, on July 25, 1932, complaining only of headache, which was of sudden onset at 2 p.m. that day. He had no other symptoms and when questioned denied any shivering; he had not vomited; temperature on admission was 101·8° F.; pulse 96. There were no catarrhal symptoms and no physical signs. On the third day after admission he had a rigor, temperature rising to 105° F.; a blood-culture was made. On the fifth day after admission he had another rigor; by this time his spleen was palpable and blood-smears showed rings and schizonts of *P. vivax*.



The patient was abroad on one occasion only, in California, for two months in 1921. Apart from appendicitis and influenza in 1931 and 1932 he has had no previous illnesses. He has not been out of England since 1921 and has no history of malaria; his infection must have been contracted in England.

He has been stationed at Ewshott from November, 1930, to March, 1932, and at Crookham Camp from 1932 (March) to date of admission to hospital. Since March, 1932, he has been sleeping in a room by himself. He has no recollection of being bitten by any biting insect during the past three months nor does he know of any friends who have recently had malaria. During the winter 1931, troops from Egypt returned to Ewshott and some of these may have carried the infection, while the warm weather in June of this year produced very large numbers of mosquitoes. The temperature chart shows the continuous temperature for the first three days, followed by the more typical malaria temperature and the rapid improvement when the diagnosis was made and the patient treated with quinine.

It is interesting to note that a case of English malaria was reported from an adjoining area (Pirbright) by Lieutenant-Colonel R. C. Priest, R.A.M.C., in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. lvii, p. 448.

Major T. O. Thompson, R.A.M.C., informs me that he has captured several *Anopheles maculipennis* in this area this year.

Echoes of the Past.

THE REMINISCENCES OF AN ARMY SURGEON.

BY LIEUTENANT-COLONEL W. A. MORRIS,
Royal Army Medical Corps (*Ret.*).

(*Continued from p.* 305.)

Passing through Rampore, we soon made a sharp turn to the left, and espied the ruins of a large temple on the right. I walked up to it, and was struck by its handsome decoration, and its solid permanent character. This is the Panchiah (Five Fakirs) Temple ; I am quite uninstructed in these matters, but can well understand the pleasure it must give an archæologist. Continuing our journey, we noticed the change in the character of the scenery, and knew we were approaching the enchanting valley. The route from Kohala was a gentle rise to between four thousand to five thousand feet at Baramula. We then descended for a short distance to the level of the river in a small plain, held the bank on our left, and in half an hour ran into Baramula. We were now fairly in the valley, and at the starting point of our wanderings for the next few months. Discharging our transport we entered the Dak Bungalow, which is pleasantly situated on the bank of the river. The view was very beautiful. In front were very high hills leading up to a vast sanctuary for all animals, organized by the State, and only very few sportsmen are allowed to visit it. Looking up the river there were numerous houseboats of various sizes and descriptions, waiting for the arrival of those visitors who had hired them, amongst them was our miniature fleet, upon which we embarked the next day. Visitors for Gulmarg, which is fifteen miles away, change here.

I called upon the Reverend Symons at his Rectory and School. This Reverend Father had been some years at Baramula, and had established a very fine school, and also had become a leading authority on Kashmir stamps.

I went all over the school and through the dormitories and class-rooms, and was surprised at their modernity (1911) and first-class healthy arrangements. Attached to the school were fine playing grounds.

Father Symons has arrangements for the sick, and I was asked by him to write a prescription for eczema capitis, which is rather common among

native children, and I selected lanoline as the vehicle for my remedy. The father laughed at me, and told me I would ruin him in no time, and invited me to inspect his method.

I found the youngsters seated on the ground, opposite to each other, with an interval. Between them was placed a basin over which they could bend their small heads, and each rubbed the other's head with the solution in the basin. This solution was made with sulphur and pepper water, an impossible mixture from a pharmaceutical point of view, but which was eminently successful in eradicating the eczema.

We engaged a large house-boat named "The Dudley," with a donga, a kitchen boat and a shikhara. "The Dudley" was a large boat with a drawing-room, dining-room, two double bedrooms, and two single, with a bathroom. I pitched a Cabul tent on the roof and revelled in the beautiful air. It would have been dangerous for a sleep-walker, which I am not.

The donga is not a furnished house like the house-boat, but more resembles certain rooms in a house. A manjhi and his family own a boat, and arrange a small sitting-room, bedroom and bathroom in the fore part, and then divide the boat with a wooden partition, behind which the family live and will do all your cooking. The top hamper is contrived of thatch supported and fixed in notched sticks with cord. The windows are crossed with light straw chicks (blinds), which can be rolled up. The front room of the donga consists of three or four feet of decking at the bows, behind which is a well, and nicely boarded space right through to the bedroom, up to the wooden division. In this well there is a table and two comfortable chairs. I prefer living in a donga to a house-boat. The kitchen-boat is a donga with the front part arranged for a stove and cooking, while in the well behind our servants lived. When a meal has been prepared and is ready to be served, the kitchen donga is pulled up to the dining-room window and the meal handed in by the table servants. When it is over, everything is returned to the donga, and the table servants step through the window, slip the mooring, and drop a few yards behind the house-boat. The last boat is the shikhara, which corresponds to the captain's gig on a ship. It is a small, light boat about ten feet long, and propelled by paddles, while between the paddles a small divan with shelter and curtains is arranged for the comfort of the travellers. The manjhis are most expert, and can send these little boats at a great rate through the water. My children became expert in the use of the paddle, and the exercise did them much good.

We pushed off from Baramula about 4 p.m. and, crossing to the right bank, were towed for a few miles. The quiet and absence of dust on the river were very welcome to us after our long journey. Our Indian servants, led by my old bearer Subhan, had everything in working order, and I recollect our first tea of toast and cakes, all served promptly and hot by our cook, and how we enjoyed it. We did not proceed far this evening, and halted for the night by the bank, dined, and went to bed early. The nights were very quiet, and nothing disturbed us. The "too-whit-

too-whoo" of an owl, or the splashing of a fish, with an occasional snore from a sleeping boatman, was really soothing and pleasant.

We crossed the celebrated Wular Lake, which can be very rough and a terror to the manjhis. The last time we crossed, we floated through a canal cut through acres upon acres of lotus plants. These presented all colours, and were at the height of their growth, and looked most beautiful. The water lily is the most gorgeous flower of the East, and when it has the fronds of the Osmunda Regalis to set it off, as I have seen it, the effect is extremely beautiful.

The great lake having been passed, our fleet was diverted into a small channel from the river, from which we should emerge at Shadipore. The boatmen prefer this route, as they escape the towing of the boats against the heavy stream of the river.

This route brought us into very close contact with the people of the little hamlets we passed, which was very interesting, and we followed it until we again emerged into the big river, and came to rest in a back water near the left bank of the Sind River, where it enters the Jhelum, and is known as the marriage place of the rivers, or Shadipur. The bank by which we were moored was in an exceedingly pretty place. I tried to catch some fish here but signally failed, while my two small daughters caught them easily and without effort. Early the next morning we entered the Sind River, and went up to a very favourite camp at Gunderbal. There are several places to tie up, but the best is on the left bank in a lovely shady spot. It had been very hot for a day or two, and we welcomed a storm which came and laid the dust, and washed Dame Nature down.

The difficulty here was the drinking water which we got from a well a mile away and boiled. This is most necessary, for cholera, enteric, dysentery and other diseases are quite common, and cholera occasionally is severe. I noticed men up to their shoulders in water collecting a plant from the bed of the river. The plant was the singhara which produces a nut. I wondered how these natives endured the cold river, which flowed directly down the Sind Valley from the glaciers and uplands of enormous mountains.

There is a fine march up the Sind Valley, and round to Lidderwat, but we did not attempt it, as we were reserving ourselves for Gulmarg, where I had hired a hut. At a short distance from Gunderbal there was the Manasbal Lake which on another occasion I visited. It empties into the Jhelum at one end, and opens out into a lovely expanse of water. The water of the lake is quite transparent for several feet. On the left of this lake as we paddled up the middle were the ruins of an old fort and palace, but I never knew the reason why they were vacated. They were now overgrown by the jungle, and the thick undergrowth prevented any exploration. On the right the country was less wild, but I noticed very little sign of huts or tenements, and only a little cultivation in places. We made direct for the head of the lake, which is flanked by a high hill that can be easily

climbed. From this point I saw one of the feeding canals to the Shalimar Gardens and the Nishat Bagh on the Dal Lake. The feeder I saw runs out from the watershed of the mountain called Harimukh, and carries the water down to the gardens, where hundreds of fountains play in the warm and fragrant air.

The sunset effects at Manasbal are very beautiful just before the short twilight arrives, when the scene changes almost as quickly as it could be done on the stage.

A day or two later we started up the Jhelum to Srinagar. This part of the journey is the least interesting in Kashmir. The stream becomes very strong, and the water is less pure, while the work of the boatmen is hard. After two hours of wearying and exhausting work, we came in sight of the first bridge, forming a pleasant picture with Srinagar behind it and flanked by the Takht-i-Suleiman and Zebawan mountains. Srinagar is a very picturesque place, and boasts of six bridges. These are native built of logs and wood, but are very strong and resist damage for a very long time. Passing through these we finally emerged on a beautiful extent of river in front of the European quarter and the Residency. Just before passing the last bridge we passed two fine palaces on our right. The first was the residence of Sir Amar Singh, brother to the Maharajah, who we came to know very well. He was a tall handsome man, speaking fluent English and had a most agreeable and courteous manner. He would come to our camp and talk for a long time, and always brought us some lovely fruit, and sweetmeats for my children. It was a great shock to hear of this prince's unfortunate death the following year. The next building was the Maharajah's Palace, a large reddish-grey building on the river edge. It reminded me of the National Gallery in Trafalgar Square. The Maharajah always celebrates the King Emperor's birthday by a state banquet here, which he attends. These functions are very well carried out, and this large palace becomes a fairy dream in the thousands of lights produced by the electric plant His Highness has installed. The scene is very beautiful and is enhanced by the exquisite music produced by the Maharajah's magnificent band.

We moored our boat at a nice place opposite the Officers' Club, in a good central position. The supplies were very good, and we were here at the height of the strawberry season, and enjoyed many a feast of these, with cream.

Our old friend P. R. Butler joined our party and added greatly to our pleasure. He is a great sportsman, and one day was tempted into a boat race with another man, whom he did not know. This gentleman's boat was floating in the same direction as ours propelled by our watermen, and at one point we were level. No two Englishmen ever allowed such a position without some sign of an endeavour to push ahead, and these two began to race. Great efforts were made on both sides, when Butler suddenly forged ahead. A lady in the opposite boat had suddenly put her

head out, and said "Darling, do you spell fusilier with one 'l' or two?" This so distracted the hero guiding the fortunes of her boat, that it fell behind immediately. It was most amusing.

The Jhelum is a dangerous river, and all my children fell into it, but were fortunately saved by the boatmen and women. They are expert swimmers, and never hesitate to plunge to the rescue. These good people must have saved many lives, and I do not think this fact is fully realized.

On the bank opposite to us, a retired Colonel who had settled down in Kashmir, and lived in a boat of his own, was in the habit of calling on the boat society in an unusual way. On the day he selected to pay his calls, he would don an elegant swimming costume, dive out of his boat, and swim to the boat of the first lady on his list. When he arrived he would climb up to the window of the lady's drawing room, sit on the boards outside and make her acquaintance. Then he would dive off to the next boat. This was an original proceeding, but very pleasant on a hot afternoon in Srinagar.

We met many friends and interchanged small hospitalities.

Not a day passed without our little society being present at some event. Races and gymkhana meetings frequently took place on the maidan, with most sporting competitions. Polo matches were played off two or three times a week. Last but not least was cricket. H.H. the Maharajah, himself a cricketer, had encouraged this game in a most lavish manner. He had organized a very strong team of his own, against which it required all the resources of the English to compete. Fortune favoured both sides. H.H., then an old man, always took a hand, and we were always pleased to play with him, if only to show him how greatly we appreciated his generosity and hospitality.

Between the maidan and the river, a small golf course had been well laid out, and very scientifically bunkered. I played many times there and always enjoyed it.

After the rains the maidan has been frequently severely damaged by floods. I believe I am correct in stating that the water has risen twelve to fifteen feet above the ground. At any rate, I saw the grand piano of Nedou's Hotel, which abuts on the golf course, snugly fixed in the upper branches of a plane tree. It had floated to this position from the hall of the hotel, which at this time visitors had to enter by boat through their bedroom windows.

A striking feature of Srinagar is the conical hill which stands behind it. This is the Takht-i-Suleiman, Throne of Solomon, and is surmounted by a very ancient temple. It is approached by a tedious but fairly easy road ; the trouble is amply repaid by the magnificent views from the top. Below lies Srinagar with the Jhelum winding under the bridges towards Baramula. Now one realizes the valley, which was not so easily seen from the surface of the river. Looking from the extreme left, the high range of the Pir Punjal closes in the side of the valley towards India. The Jummoo

Pass, which is twenty-four miles from Sialkot, leads over the mountains to Islamabad, and is the more or less private route used by the Marahajah when he leaves his winter quarters at Jummoo, for Srinagar.

The Pir Punjal Pass is the higher of the two, and before the Pindi-Kohala-Baramula road was made, was the chief route for travellers going to Kashmir, but is seldom used now. It is approached from Gugerat and Bhimber, and opens into the Shupyan district of Kashmir. The highest peak on the Pir Punjal is Hutti Tutti, 14,000 feet. Hutti Tutti is situated just above Gulmarg, where we camped later. Looking round, to the right, some high mountains appeared, notably Nanga Parbat, the fourth highest mountain in the world, 28,000 feet. At our feet lay the beautiful Dhal Lake, with its scarcely less charming sister the Anchar Lake.

Hari Parbut is the military fort of Srinagar, but has no striking features. The state prison is here.

The Dhal Lake is approached from a canal, by passing under a bridge called the Dhal Dawaza, or Gate of the Dhal. The canal is commonplace, but the moment the gate is passed, and this wonderful lake is reached, the effect is of extraordinary beauty. One seems to have passed from a dull murky stream to a new country in the space of a few minutes. There is a marvellous brightness of the atmosphere, and a thousand changes of colour as the light is reflected from the brown mountains, or from the green plane trees, or filtered through tall reeds, or reflected directly from the water and lotus flowers. Even the fish can be seen at the bottom of the lake quite easily in this wonderful light. We brought our house-boat through and tied up for the first night at Gupkar, lying at the back of the Tacht. It was a delightful spot, close to Sir Amar Singh's country residence which we were permitted to visit. We also examined the spirit distillery and wine-making premises. The Kashmir wines promise to be quite good when a little more time has passed in maturing them. High up on the hill behind us was the Peri Mahal, or Fairies Palace —a succession of cells on platforms and quite neglected. It is an uncanny place.

The next day we passed to the Nishat Bagh, or Garden of Gladness, where later we received an invitation from the Maharajah to an entertainment to celebrate the Feast of the Lilac. The lilac trees were in full bloom, and the lovely gardens with all the fountains formed a dream of transcendent beauty. I noticed in our corner some native musicians playing their zithers under a wealth of bloom, and singing a low-toned chant, which rose and died away in delightful cadences. The natives were dressed in bright colours and looked thoroughly happy. It was an ideal scene of joy and gladness. The Maharajah received his guests on the highest terrace and was most kind and amiable.

The British staff with the Resident and all the State officials were present, and with the other guests were sumptuously entertained. The

Maharajah's band, about seventy-two strong, played appropriate music, which blended well with the exquisite scene. These wonderful entertainments are unique and can never be forgotten. It was in this garden and its neighbour, the Shalimar, that Jehangir and Shah Jehan, the great Moguls, spent their summers in great luxury. The view across the Dhal Lake from the terrace of the Nishat is very fine, and in the distance the Tacht-i-Suleiman and the Fort of Hari Parbut show up very clearly. It was in this garden of loveliness that we passed some of the pleasantest days of our lives. We moved on the next day to Nizam Bagh, or the Garden of the Morning Breeze, on the opposite side of the lake. Having moored our fleet, we pitched camp a short distance away under two plane trees. These are very common in Kashmir, and are cultivated for their shade in the heat, and their exquisite beauty and form. They grow into very large trees, and their palmate leaf is much copied by workers in silver, silk and copper. We found this camp very bracing in the heat, and the time passed very pleasantly in sketching, photography, golf, and making short expeditions in our shikhara. We saw many wild ponies in the woods behind our camp, and were also interested in watching natives taking the silk they had carded from their cocoons to the well-known silk factory at Srinagar, where they receive payment and eggs for the next season.

I was never able to pay a visit to the factory, but my wife did, and was greatly interested in all they were good enough to show her. This manufacture of silk is likely to prove a very valuable and productive asset to the the State of Kashmir.

With my elder daughter, then eleven years old, I proceeded in my donga to visit the Shalimar Gardens. She and I lived in our boat at the end of the canal, and just opposite the buildings and gate of the garden.

The entrance to Shalimar is small, and not striking. It consisted of a centre building over an outlet of the water from the fountains. It is quite possible that the designers purposely subdued the first impression in order to develop the finest effect at the Pavilion at the opposite end, about a quarter of a mile away, and up a slight rise. Passing through a small archway, we emerged on a beautiful scene.

Running up the centre for about 100 yards is a channel of marble, about 12 feet wide, with fountains at intervals of 6 feet, down the centre. On each side is a 16-feet terraced path, and outside these magnificent chenar trees shed a grateful shade. At the end of the first 100 yards there is a finely built bridge with a ziarat, and in front a square space of water with fountains. These are on a slightly higher level, and the water falls into the channel by a pretty cascade. Beautiful flowers fill in the spaces, and there are palms in tubs, with well laid out grass plots.

Passing this, we came on a similar scene, but extending for double the distance, and the half-way is marked by a slight rise in the level and a cascade with water falling down. The division possesses no centre, but

only alcoves on each side, which allow us to see a long length of stream and fountains, till arrested by a smaller building or ziarat, right across the stream, and similar to the first. The picture became more beautiful and varied as we approached, with the fountains playing in the heat, and beautiful birds and multi-coloured butterflies flitting in the sunlight, gave an ineffaceable impression to the visitor.

Passing up steps and through an archway, the last stage is reached. This is the upper terrace, and is screened off on account of the royal ladies with the Mogul. The centre stream passes a comparatively short distance, and receives by a cascade the water from a large square of water with 140 fountains, in the centre of which is the Royal Pavilion. This is an oblong building, with an elegant chaste roofing, richly carved, and supported by black marble pillars of great strength and beauty. The proportions and the setting are enchanting. Nowadays this beautiful garden is neglected, but at the height of the Mogul dynasty it must have been exquisite. The whole lies with a grand background of mountain.

It is difficult to leave this place, where every detail seems to call for remark. We spent three days here, and then returned to our headquarters and prepared to advance up the river to Islamabad.

A day later, having laid in provisions and a good supply of asparagus, we were silently moved from our moorings, and, when we awoke, were gradually being towed up the river. Late in the evening we tied up on right bank just below the old bridge of Pampoor, which has since been carried away. It was a wonderful and tough monument of the past, constructed of logs and creepers. Here we tied up our boat. The bridge formed a pretty picture, but I understand it is now replaced by a vulgar iron structure.

Our camp lay on a grassy lawn shaded by large chenars, and there was a temple near, but we noticed nothing more of interest. We remained here one night, and early the next day passed through the bridge and continued our journey. The stream was strong, and the weather squally and uncertain. Our progress was slow, and we tied up about midday temporarily, in the hope that the weather would improve. Suddenly a gust came and caught the house-boat, so that she broke her moorings, and was going fast down the stream, and being blown at the same time to the the other bank. Luckily the river was wide, or I do not know what might have happened. The boatmen pushed off after us in the small boats, and climbed on to the big boat just in time to get her under some control, before we crashed into the opposite bank. Fortunately, the bank was shelving and eased the force of the impact. We tied up here, and spent the rest of the day in rain, mist, and cold.

By the next morning all the angry clouds and cold rain had given place to a blue sky, a hot sun, and an invigorating breeze, so we pushed on happily to Bijbehara, and occupied a delightful camp on a beautiful grass lawn with plenty of shade. The scene from this camp is very pleasing.

The river flows round a slight bend, and shows the old bridge of this place, while in the distance the snowy range is clearly discernible.

Bijbehara is the key post to the Shupyau district and the Pir Punjal on the south, and to Pailgam and the Liddar Valley on the north. We were not able to visit the Liddar, which I shall always regret. Leaving this delightful spot, we made a comparatively short run to Islamabad. This is the last place that large boats can reach, though smaller ones can pass a little further. The place at which we tied up was under a steep, uninteresting bank, with a swift current. It was here that my eldest daughter fell in, and was only saved by the courage and prompitude of a boat-woman, who plunged in and rescued her.

Islamabad is a dirty place of no interest. My younger daughter started fishing (she was eight) in the Temple tank, and was pulling out holy carp at a great rate, when she was requested to stop. However, the pious ascetics were very reasonable. Atchibal is near here, and also the ruins of the Temple of Martund. The weather was becoming very hot, and our time to proceed to Gulmarg had arrived, so we started from the highest place boats could reach and commenced our return journey to Baramula, and then to the mountains. The journey was quite uneventful, but we were sorry to leave our fleet and the good boatmen, who had served us well.

Preparations for our march to Gulmarg, sixteen miles, were well advanced by the time we had finished our early breakfast. We had no trouble with the coolies who would carry our luggage, while the ponies appeared quite good, especially the one told off for me, which was a large rampant horse, and squealing at every other member of the genus. My bearer reported that the syce of this animal was lying on the ground and refused to move. I went out and examined him carefully, and found nothing at all wrong, and insisted that he must go. He still refused, and lay on the ground. Then my bearer acted; he collected some grass and sprinkled it over the prostrate form, struck a match, and set fire to it. The syce got up and avoided the flames, beamed with admiration at the bearer, and agreed to carry out his duty. This he did without further incident.

It is a very pleasant ride to Gulmarg, and there is an excellent camp about half way at Kauntra. It gets hot afterwards till Bapamarishi is reached. Here the ascent is steep, but it is not long before we reach the entrance to this beautiful valley, perched up in its cradle in the mountains. We crossed the valley to our log cabin near the fort, and settled down for three months enjoyment of this delightful spot. On the north side is the mountain of Apharwat, flanked by the nullah, and some high snow peaks on the Pir Punjal range. On the south a wooded crest bounds the valley, on the west a long nullah runs down towards Uri, which is on the main Pindi Baramula route. The east also leads into the valley towards Srinagar.

The valley is divided into upper marg and lower marg (or fields). The first is the larger and is about one mile long, and half a mile wide, and is more level than lower marg, which measures a little less. The big marg is surrounded by huts dotted in the forest, while the Maharajah's palace, Nedou's Hotel, the Club House and little Church occupy conspicuous positions.

The Club House is beside the main road and is a very sociable place. It is surrounded by three tennis lawns, polo and cricket grounds, and the golf course. Here the little British society meet and have tea, play bridge, and read the papers.

A small river winds through the valley, and lends itself in a remarkable manner to increasing the difficulties and intricacies of the golf course. I believe that to General Sir Neville Chamberlain, K.C.B., who at one time had a long tour of duty in the valley, is due the credit of marking out the original course. which has not varied much in the last twenty years. In my time the first hole started from the road to the left front of the Club House; it may have been changed now. The hole started with a very pretty drive over the river at about eighty yards distant, with a bank forming a scarp of about ten or twelve feet. It required a good honest drive, high enough to clear the scarp, to be safe. A long iron shot, if straight, could reach the green, but any pulling or slicing spelt danger. I think bogey was four. The second hole was a drive over a shoulder and down to the river with a short approach. Four simple greens followed till the Kotal hole was reached. The tee was below the Kotal and the direction of the hole was indicated by a post. The fairway is down and across the river on to an island. This hole requires a long lofted drive, so that the ball falls more or less dead on the green. Anything short or too long spelt difficulties, lost balls and tempers. This hole was appropriately called "Paradise Lost." The next hole, which was known as "Purgatory," involved either a long drive and a long brassey or cleek to reach the hole at the base of a short cliff, and again over the water. If these shots were short, there was a great risk of the ball falling into the river; most players took two to the cliff, and a mashie stroke to the green, but these shots were full of danger unless well played.

The next hole was considerably easier, and was called "Paradise Regained." One more hole, and we reached the Serpentine. The drive here was over two or three short windings, and was rather baulking, as it looked so difficult. There was one more hole worth noting; it formed a drive to the foot of a small hill, with the green perched up near the top, and required an accurate loft. This hole was called Mount Ararat. I hope these old names have been retained.

The height of Gulmarg is 10,000 feet, and as its name implies it is a veritable field of beautiful flowers, flanked by dark green pines, deodars and larches, while over all is Aspharvat with some snow still to be seen. Just below Aspharvat is Killanmar at about 14,000 feet and a favourite place

for picnics. It is really in the snow below the glacier. The time passes all too quickly with dances, cricket, tennis, shooting. I played golf, and a good deal of chess with an old friend of mine, Padre Gompertz. Sir Francis Younghusband was the Resident, and it was my pleasant duty to call upon him. At the time I was just getting over an attack of fever, so I chartered a quiet nag from the bazaar, and was carried across the marg and through the bazaar to the entrance foot-path leading to the Residency. When I reached the place, I saw the Maharajah strolling away from an interview, so I quickly dismounted and sent the unkempt steed away, and addressed H.H. in my best Urdu. He listened courteously and then slyly asked me in English "Are you going to visit the Colonel Sahib?" I apologized for not recollecting how well he spoke English; he laughed it all off. I met him a few times, and always found him most gracious and kind.

Here my pleasant tour in Kashmir must end, and to my last day I shall always remember it with delight.

About this time I was recalled to officiate as Principal Medical Officer of the Allahabad and Fyzabad District in the place of Colonel L. E. Anderson, who was ordered to relieve the Surgeon-General of the Bengal Army at Naini Tal.

I was now within six months of my permanent retirement under the age clause, and I thought it was a remarkable coincidence that I should end up in India, where I had commenced twenty-nine years earlier. General J. C. Keir (now Sir J. C. Keir, K.C.B.) had gone home and Brigadier-General Shaw was now in command. There had been many changes; my time was fully taken up with my duties, and I had little to spare for social amusement, besides I was so often away on inspection duty. A month or so later I had to control a considerable and difficult outbreak of cholera among British and Indian troops. This outbreak possessed so many interesting features that I purpose concluding this part of my service with a description of it. At least, it will show that we do have anxious and strenuous work in India.

One morning in October I received a cipher telegram which informed me that cholera had broken out at Benares and that fifteen cases had occurred and seven deaths. I took the telegram on to the General, and told him that I would proceed there by the next train; he said he would come too, and back up with his presence and authority all my recommendations. General Shaw helped me enormously by this attitude, and I greatly appreciated his sympathetic and practical support during a most trying time. We left Allahabad by the afternoon train, and reached Benares about 7 p.m., when Colonel Drever met us, and reported that more cases had occurred. We drove straight to the Hospital and found the medical officers doing splendid work with the sick, and at the end of the outbreak they had fully maintained a good average of recoveries. We then returned to Clark's Hotel, and had dinner. Drever dined with us.

The following morning the General accompanied me at an inspection,

and I saw every man. I spoke to them and called for volunteers to bury any more fatal cases, and suspended funeral parades; and I also recommended an immediate march to the first sanitary camp. I started off to inspect it, and to my chagrin found that it had been overlooked, and could not be occupied, so I rode on to the next camp, which was in good order, but involved a double march, which I would have been glad to have avoided. Fatigue is not to be encouraged when cholera infection is about. Returning, I met the regiment marching out, but before they reached camp three more cases were removed to hospital.

It had been a very fatiguing day, and we ended it by dining with Colonel Drever, and a Major and his wife.

The next day we devoted to the Station, and were encouraged to hear that no further cases had occurred in camp. It was evident that the infections were weaker, and would gradually end. The G.O.C. asked Colonel Drever to dine with us, as we were returning to Allahabad the next day, and he would be able to discuss the situation. Drever arrived, and I noticed that he looked worried and anxious, and was not eating. I made him drink champagne, but he was in a state of much depression, and soon left remarking that a good sleep would put him right. At 3 a.m., he sent for me, and I saw at once he had cholera. He remarked "The microbes have got me, old chap—got me at last." I comforted him and left him with his doctors, and never saw him again, for he died an hour or so later. We did not hear of this till the next morning at Allahabad, and also that the lady who dined with us at Drever's house was very ill with a choleraic condition. She happily recovered.

I had not been at Allahabad a few hours before a wire reached me that cholera had broken out at the Gurkha Station of Gorakhpur, the farthest outpost of my charge on the Nepal frontier. At this time Gurkhas were returning from leave in Nepal, and assembling at Gorakhpur, prior to joining the Durbar at Delhi, for this was the year King George held the 1911 Durbar at Delhi. Besides, in the valley of the Gogra River, between Gorakhpur district and Nepal, was the reserve for His Majesty's big shoot with the Maharajah of Nepal.

I received telegraphic instructions to be careful not to allow the troops assembling at Delhi to be infected with cholera from Gorakhpur, and also to recollect the proximity of the Royal shoot.

I travelled all night to Lucknow, where I had to wait six hours, so I visited Harry Thompson, the S.M.O., Lucknow, and while he played a game of polo, I decided to visit the Residency, which I had not seen for many years. Thompson lent me a horse and trap, and I drove myself to the gardens about 4 p.m., and he promised to call for me about 6 p.m. I entered the gardens and quite suddenly felt a sense of intense depression, and inertia, and I sat down on a bench. This had no relation of any sort to the scene or anything connected with the Mutiny. I was utterly lonely. Thompson told me to go over the Museum, and I was anxious to see it, yet

though it was only a hundred yards in front of me, I made no effort to enter it. The old Eurasian who was for so many years the attendant, approached me, but what our conversation turned upon I have not the remotest idea, yet I have a good memory. I sat still there till Thompson came and inquired what I thought of the Museum, and was surprised that I had not seen it. My time spent there is a blank I have never been able to fill up.

Thompson drove me to the Chutter Munzil, and then to his house, and the condition passed off.

It was a guest night at the Mess, and Surgeon-General Irvine, R.N., was the chief guest, and Thompson placed me on the other side of this naval officer and asked me to entertain him; I think that delightful gentleman of the Senior Service enjoyed a pleasant evening, between Thompson and me. The R.A.M.C. Mess at Lucknow was at the zenith of its popularity, for Thompson was one of those men who would have the best or nothing. A strong personality, he was beloved by his staff, and he was, in my opinion, one of the best all-round officers the R.A.M.C. ever possessed. He rose to the highest rank, and died at Osborne. My last evening at Lucknow was the gayest of the gay, and we kept it up till late, but at eleven I had to clear off and catch the midnight train to Gorakhpur.

All the depression had passed, and I packed up in the carriage and went to sleep. At 3 a.m. I awoke, and felt this awful depression again, with niggling pins and needles in my legs, and intense restlessness, but I thought I was perhaps a little overdone, and that it was some reaction from the recent strenuous time I had had. I reached Gorakhpur about 7 a.m., and was met by the M.O., who reported that all the cases which had occurred had ended fatally.

Remembering my instructions from Simla, I took scrupulous care to reduce the risk of any infection passing this post, and I daresay some of them seemed tiresome and unnecessary, and left again for Benares direct. When I arrived I found the epidemic well in hand, and returned in the evening to Allahabad; found General Shaw recovering from a severe attack of choleraic diarrhœa. The next morning I heard that Surgeon-General Irvine had succumbed to cholera. I wrote a long report on this outbreak, which was received by Colonel Firth, the Sanitary Officer, who straightened out some of my difficulties. My depression and pains in the garden and train were the result of a mild infection acquired at Drever's dinner party, as had also happened to the lady and the General. Poor Drever's infection was so close on the dinner that it may be questioned as a cause, but I think he derived his infection from the same source. It transpired that his table attendant lived in the bazaar, and his daughter had died from cholera in the same week. Surgeon-General Irvine's death could not have any connection with this outbreak, but it was a singular coincidence that I should have sat next to him at that dinner at the Mess.

The rather strenuous time passed away, and I only received one

more shock in the form of a wire which conveyed the information "Two fresh cases" from Gorakhpur. I rushed off, for this was the most anxious and sensitive spot in my charge. When I arrived, the Medical Officer reported that no fresh cases had occurred. I showed him the wire I had received. It was then clear that the "T" which follows the number of the wire had been added to the word "No," making the word "T.n.o," which I read "T.w.o."

Current Literature.

WALKER, H. M. **Diphtheria Toxoid.** *U.S. Naval Med. Bull.* 1932. Vol. xxx, p. 369.

It is stated that the use of diphtheria toxoid has many advantages over toxin-antitoxin; a more certain and lasting immunity in a shorter period of time, and, in comparison with toxin-antitoxin, less unpleasant effects.

As only scanty data are available regarding its use with adults, the author publishes his results, obtained at the U.S. Naval Hospital, Brooklyn, in the immunization of a group of men whose ages ranged from 18 to 35 years. Of this group, i.e., 201 healthy adults, 49 were found to be Schick-positive. The reaction test for diphtheria toxoid was then made on the Schick-positives: 34 were negative and 15 positive.

Thirty of the thirty-four toxoid-reaction test-negatives were given on January 19, 1931, one cubic centimetre of toxoid subcutaneously. Six suffered from reactions sufficient to keep them in bed for four or five days; the remainder had either no reactions or very mild ones.

The second dose of one cubic centimetre of toxoid was given on February 2, and only one of the thirty had a severe reaction.

On March 18 only five of the thirty cases were found to be Schick-positive; on May 16 all were Schick-negative, indicating 100 per cent immunity three months after the second dose of toxoid; and again on October 4, eight months after the second dose of toxoid, all were found to be Schick-negative.

Tables showing results and symptoms after the administration of toxoid are given by Lieutenant Walker, and in a summary he suggests that as the severe reactions following toxoid injections are no worse than those following toxin-antitoxin, and in view of its many advantages, the toxoid should be used in preference to the toxin-antitoxin.

REED, J. G. **Note on the Passage of Plasmoquine Compound Tablets in the Stools.** *Trans. R.S. Trop. Med. and Hyg.* 1932. Vol. xxvi, p. 95.

Two cases in Tamil coolie women in the Federated Malay States are here recorded in which plasmoquine compound tablets have been recovered almost unchanged from the stools.

The first case was admitted to hospital with a temperature of 105° F., an enlarged spleen and a history of bilious vomiting. She had received quinine prior to admission ; parasites were not found in the blood. Sinton's treatment, with one tablet of plasmoquine compound three times daily, was given, so adjusted that she took thirty grains of quinine bihydrochloride salt a day. In spite of this and two intramuscular injections of quinine, the temperature continued to oscillate for eight days. Santonin treatment was given on the fifth day and, in searching the stools the next day, about three tablets of plasmoquine compound, somewhat broken but recognizable, were recovered.

In the second case benign tertian parasites were found in the blood. Treatment similar to the first case was adopted, except that an expectorant mixture was given instead of an alkaline mixture. Oil of chenopodium was given on the fifth morning, and the same evening six plasmoquine compound tablets were recovered almost unchanged from the stools. No tablets were taken on the day the chenopodium was administered, so that some must have remained in the patient for at least forty-eight hours.

The author states that the tablets have never been seen in other stools, although many patients have received them.

SAYERS, EDWARD G. **The Treatment of Tropical Ulcer by the Method of Dickson Wright.** *Trans. R.S. of Trop. Med. and Hyg.* 1932. Vol. xxvi, p. 49.

This paper does not purpose to deal with the clinical description of tropical ulcers, and the author states that he has no light to throw on the rather vexed question of their pathology. It is published mainly to report a line of treatment, i.e., the application of Dickson Wright's method of treating varicose ulcers which, in the author's experience, has been found very promising in dealing with tropical ulcers at Bilua, British Solomon Islands.

The two main objects of Dickson Wright are, according to Dr. Sayers, the correction of vascular stasis and the hermetic sealing of the ulcer, and he quotes Dickson Wright as follows in attaining these objects :—

"The highest visible varicose veins are injected with five per cent sodium morrhuate; then, no matter how fœtid and dirty the ulcer may be, the leg is firmly encased from foot to knee in a three-inch spiral bandage of elastoplast adhesive. The zinc oxide and rubber adhesive is spread upon a domett base in this type of bandage ; it is comfortable, lies smoothly on the leg, and is very rapidly applied. To prevent any tendency for the bandage to 'creep,' two nine-inch longitudinal splints of the same material are laid on the sides of the leg above the ankle, and the spiral is applied over these. The patient is then instructed to walk home. She will notice while doing so that the bandage, most uncomfortably tight at first, soon adjusts itself to the leg, and she experiences comfort which has been unknown to her for years. A very gratifying feature is the improvement in sleeping which results. The patient is also instructed to work, to

seek for work, or to take exercise. Discharge will seep through the bandage, and should be washed off with soap and cold water. It is explained to the patient that a free discharge is beneficial."

The author of this paper was unable to obtain the special bandages, and most of his cases—ten are described in the paper—were treated with ordinary adhesive plaster, although later some Leslie's "zopla" bandages, which are easier to apply, were used. He considers, however, that his results with these bandages were no better than with the plain zinc oxide plaster.

The first case recorded in the paper is typical of the remainder. This was in a male, aged 45, who in May, 1931, came to hospital with an ulcer (two inches by one inch), punched out, deep and with a sloughing base, in the lower third of the right leg. Novarsenobillon injections and treatment by eusol, acriflavine and mag. sulph. solution (7½ per cent) for one month was given without effect. On August 23, 1931, when seen by the author, the ulcer, then 3½ inches by 2 inches, was very deep and sloughing, with a very foul discharge. Eusol dressings and perchloride baths were applied for two weeks with no good result. The leg was then strapped, and the discharge, the stench of which was very objectionable, soon soaked through the strapping. On the fourth day the strapping was removed, when the edges of the ulcer showed signs of healing, although there was a foul discharge and a slough at the bottom. The base of the ulcer, after removal of the slough, showed bright red granulations. The strapping was then removed weekly. The discharge soon ceased and after seven weeks the ulcer was healed. Five months later the leg was still soundly healed with an excellent scar.

In a commentary and summary the writer states that the first dressing was usually changed after one week and thereafter it was often left on for a fortnight. In one case where the bandage had been left on for twenty-three days the ulcer had completely healed. Treatment, which is inexpensive, does not interfere with work and medical attention is required only once a week or once a fortnight. In the author's experience it is confirmed that there is no danger in imprisoning the septic secretions of the foulest ulcer. No special skill is required in applying the treatment, which is particularly suited to native patients who soon tire if in- or out-patient treatment is prolonged.

Edgar, Surgeon Commander W. H., R.N. **Scarlet Fever: An Effort in Preventive Medicine.** *Proc. R.S. of Med.* (United Services Section). 1932. Vol. xxv, p. 1431.

This paper records work carried out at a Training Establishment of the Royal Navy, at Gosport, among about 600 boys, whose enlistment age is 15¼ years and who join in batches of twenty-five every three weeks; the boys are destined for the seaman branch of the Navy. At the establishment there are ample playing fields and two swimming baths, and the place resembles a large public school in its lay-out.

When the author took over medical charge he found scarlet fever persistently present, but diphtheria almost absent, and as a first step in the campaign he isolated the whole establishment from outside contact for the first three weeks. During this period he conducted an intensive search for carriers, but none was found; he next Dick-tested the boys, with the consent of their parents, as a routine as they joined in their batches of twenty-five.

By the end of 1931, 865 boys had been tested, of whom 177 (about twenty per cent.) were positive. The prophylactic course was given to 168 boys, entailing 667 individual injections. The author states that he usually begins the injections with 500 skin units, proceeding in weekly doses of 1,000, 5,000 and 10,000, the four injections taking a month.

He estimates the cost at contract prices at one penny for the Dick test and a half-crown for the prophylactic course per head—"an insignificant sum compared with the cost of nursing a case of scarlet fever."

The writer of the article states that the immunization of all the boys had not been achieved until the end of 1931, and although the results which he gives refer to that year, yet he considers they should not be taken as a final estimate of the efficacy of the measures.

The incidence of scarlet fever in the establishment for 1931 was 10 per 1,000, as compared with 47·5 per 1,000 for the three previous years; the disease is definitely less infectious amongst the boys and occurs as sporadic cases rather than in small epidemics.

The relation between the anti-scarlet fever measures and the six cases which occurred in 1931 is discussed, and it is concluded that while it may not be possible entirely to purge scarlet fever from a large collection of boys living in close proximity, it would appear that its incidence can be lessened; more important, the disease can be reduced to an almost non-infectious one, as the result of building up a communal immunity.

DYER, R. E., WORKMAN, W. G., RUMREICH, A., and BADGER, L. F. **The Preparation of a Vaccine from Fleas Infected with Endemic Typhus.** *Public Health Reports*, U.S.A. 1932. Vol. xlvii, p. 1329.

The authors in making their vaccine followed the method of Spencer and Parker, who prepared a vaccine against Rocky Mountain spotted fever by phenolizing emulsions of infected ticks. Dyer and his co-workers used typhus-infected fleas as a source of virus. The fleas used were *Xenopsylla cheopis*, which were emulsified in salt solution after feeding on infected white rats.

In their first experiment the vaccine was considered to be too weak, so a second vaccine was prepared from freshly-infected fleas, emulsions of which showed that there was sufficient virus in one-fiftieth of a flea to infect a guinea-pig. Four-tenths per cent phenol was added to the emulsion and the mixture allowed to stand for five days. Each cubic centimetre represented the virus from twenty fleas. Forty-four guinea-pigs each received

one cubic centimetre of this vaccine, and by the inoculation of emulsions of the spleens of five of these animals into other guinea-pigs at the end of ten days, it was ascertained that the vaccine was free of live virus. Fifteen of the remaining thirty-nine guinea-pigs died before the test for immunity was carried out.

Of the 24 vaccinated guinea-pigs, 8 were tested for immunity to endemic typhus between two and three weeks after vaccination. Six were found to be non-immune, 1 developed scrotal lesions only, and 1 showed fever on one day.

The remaining 16 vaccinated animals were tested for immunity between two and three months after vaccination. Three were non-immune, 3 developed fever without scrotal involvement, 1 had fever with doubtful scrotal lesions, 1 had scrotal involvement for one day with no fever, and 8 showed no evidence of typhus.

From these experiments, carried out with a vaccine prepared from fleas containing a virus of low potency, the authors consider that it seems reasonable to hope that a vaccine made from a virus as potent as that recently reported by them, in which one hundred and twenty-eight thousandths of a flea contained enough virus to infect a guinea-pig, should give a higher degree of protection.

PUGNANI, E. Osservazioni sui metodi di differenziazione dei batteri de gruppo delle brucelle. **[Methods of Differentiating Organisms of the Brucella Group.]** *Giorn. di Batteriol. e Immunol.* 1932, v. 8, 231-42. [20 refs.] English summary (5 lines).

The author has submitted a number of Brucella strains to the following tests: (1) Trypaflavine agglutination, a final dilution of 1/1,000 in saline being used; (2) agglutination by 1 per cent. peptone in distilled water; (3) H_2S production. He finds that *abortus* strains produce H_2S, but are not agglutinated by trypaflavine or peptone; that *paramelitensis* strains are agglutinated by these non-specific agents, but do not produce H_2S; and that the majority of *melitensis* cultures neither produce H_2S nor are agglutinated non-specifically. G. S. WILSON.

Reprinted from "Bulletin of Hygiene," Vol. 7, *No.* 8.

LINDSEY, G. A., and MECKLER, C. M. **Two Rapid Methods for distinguishing between** *Escherichia coli* **and** *Aerobacter ærogenes*. *Journ. Bact.* 1932, v. 23, 115-21, 1 fig.

The methyl-red and Voges-Proskauer tests, as applied in bacteriological water analysis to distinguish between *Bact. coli* and *Bact. aerogenes*, have the disadvantage of requiring five days' incubation in a special medium. Moreover, the distinctive colour of the Voges-Proskauer reaction may develop very slowly after the addition of the potassium hydrate solution. Werkman has reported that if two drops of a 1 per cent. solution of $FeCl_3$ are added to the culture before the KOH a distinctive coloration develops within twenty minutes. The authors obtained such strong readings by this method

that they were led to examine the possibility of shortening the incubation period and using an ordinary dextrose broth medium. They found that growth for twenty-four hours in 0·5 per cent. dextrose broth, followed by this method of testing, gave results identical with those obtained by the official five-day test. They record also a series of methylene-blue reduction tests that served to differentiate between *Bact. coli* and *Bact. aerogenes*. Tubes of lactose broth were inoculated and incubated at 37° C. for twenty-four hours, one drop of a saturated solution of methylene blue was added, the tubes were shaken, permitted to stand for one hour, and examined for dye reduction. *Bact. aerogenes* gives complete reduction under these conditions, but no visible reduction occurs with *Bact. coli*. W. W. C. Topley.

Reprinted from "Bulletin of Hygiene," Vol. 7, No. 8.

Skinner, C. E., and Baskin, A. H. **Lactose Fermenting Anaerobes in Soil and their Relation to Sanitary Water Analysis.** *Proc. Soc. Exp. Biol. and Med.* 1932, v. 29, 551-4.

Using plate cultures and an iron-sulphite medium incubated under conditions of moderately strict anaerobiosis and, as an alternative method, the production of stormy fermentation in milk, the authors have determined the approximate numbers of lactose-fermenting anaerobes of the *Cl. welchii* type in samples of apparently unpolluted soil from forests, peat bogs or unmanured fields. With the plate method, anaerobes of this type were isolated from all samples examined, the approximate number per gram of soil varying from 6 to 5,600. With the dilution method, using stormy fermentation of milk, all samples gave positive results, the most probable number of anaerobes per gram of soil varying from 2 to 10,000. The authors conclude that the presence of anaerobes of this type in a water-supply cannot be regarded as evidence of fæcal pollution. W. W. C. Topley.

Reprinted from "Bulletin of Hygiene," Vol. 7, No. 8.

Reviews.

Fractures. By Meurice Sinclair, C.M.G., M.B., B.Ch.Edin. London: Constable & Co., Ltd. 1931. Pp. xxxiv + 550. 24s. net.

This is one of the Modern Surgical Monographs edited by G. Gordon-Taylor, O.B.E., M.A., F.R.C.S., and contains an introduction by Sir Robert Jones.

Those who saw Major Sinclair's work at first-hand during the Great War, at No. 8 Stationary Hospital, and have read his previous book on the Thomas splint, which was published in 1927, will read this volume with great interest.

This is a far more ambitious venture than the previous small volume published by Major Sinclair, although, as he points out in his preface, he has only attempted to deal with the more common forms of fracture. That the types of fracture selected for description have been exhaustively dealt

with will be evident from the fact that the book consists of 550 pages, and is profusely illustrated by 337 figures, including many reproductions of radiograms.

Most surgeons recognize that the treatment of fractures underwent profound modification by the vast experience gained during the war, and Major Sinclair attributes any success which was attained to the re-discovery of the Thomas splint, and the correctness of his view is supported by the fact that the use of this splint is a war method which has survived.

In pre-war days, a student at his final examinations in London would have been a brave man if he had suggested this splint as his first choice for the treatment of a fracture of a long bone; now no London hospital is without the Thomas splint, and all First-Aid organizations standardize instruction in its use.

The reviewer read the book with a critical mind and was much interested to observe how Major Sinclair's methods had stood the test of time and the modifications that he had introduced from experience in the treatment of fractures unconnected with gunshot wounds, but occurring from the ordinary accidents of civil life.

Major Sinclair soon makes it clear that further experience has not shaken his faith in the Thomas splint. Some small refinements and improvements have been effected in the methods of use, but the main principles laid down by him remain unaltered, and the accounts of serious fractures treated and the results obtained, confirmed by skiagrams, go to show that in his hands the methods are effective.

In compound gunshot fractures internal splinting by metal plates or other types of direct fixation was definitely contra-indicated, and surgeons were nervous about using methods of extension which necessitated transfixion of bones by pins, or other methods, in close proximity to severe wounds. Major Sinclair therefore developed and improved methods of surface extension by glue, etc., and a perusal of the present volume shows that while he still uses surface extension and suspension he now inclines towards direct fixation in all cases where perfect reposition of fragments cannot be obtained by extension.

But even with direct fixation of the fracture, Major Sinclair is faithful to his first love, the Thomas splint, and advocates its use for practically all fractures after operative fixation. While not entirely discarding plaster of Paris as a method of splinting, he only uses it for a few spinal types, on the principle which he constantly reiterates, that the most effective immobilization and reposition of a fractured long bone is attained by extension in the correct plane.

It is noticed that extension applied to the lower limb by screws inserted in the tibia has continued to give very satisfactory results in his hands.

While Major Sinclair makes full use of the walking caliper splint, he can hardly be described as an advocate of the ambulatory treatment of fractures, and tends to keep his cases recumbent for considerable periods.

This is one of the difficulties that is encountered by institutions where it is desired to apply Major Sinclair's methods, for the shortage of beds in most general hospitals precludes the retention of fractures until a complete cure is effected.

The book is rather a plea for the provision of sufficient beds for this purpose, and there is no doubt that treatment in special fracture wards in each hospital, with a specially trained surgeon in charge of the cases, would give better results, and there would be less after-disability. But many surgeons will be doubtful if the long periods advocated by Major Sinclair are in all cases necessary.

For the student the book can hardly be recommended as a complete guide to the treatment of fractures from the examination point of view; but those who adopt these methods and carry them out with the meticulous attention to details, as advocated by the author, will obtain results which are second to none.

The Thomas splint is not fool-proof, and if it is carelessly used good results cannot be expected. Regular checking of the position of the fragments by periodic skiagrams is rightly insisted on.

Many ingenious modifications of instruments for operative treatment of fractures are illustrated, and for these many surgeons will be grateful.

Major Sinclair is at his best when dealing with fractures of the long bones. The short section on fractures of the jaw, skull and vertebral column are so sketchy as to be of little value to the student, and none to the medical man who takes up the book for guidance in a serious case of fracture in these regions.

The omission of any reference to separation of the lower epiphysis of the femur is noticed. Its inclusion in future editions would be an advantage.

The book is very readable. It is well produced, the type is good, and the illustrations of instruments and appliances and the reproductions of skiagrams are excellent.

The volume will be of special interest to military surgeons, for if ever this country is again plunged in the horrors of war the methods of Major Sinclair will be found to be those of choice for gunshot fractures of bone, and he is to be heartily congratulated on this very fine exposition of his methods. The editor and publishers have succeeded in producing a very readable and handsome volume which should be in the library of every one who is interested in one of the most important conditions met with by surgeons.

J. W. W.

REMINISCENCES OF PEOPLE AND PLACES. By Lieut.-Colonel R. Gillham Thomsett, late Royal Army Medical Corps. London: Arthur H. Stockwell, Ltd. 1932. Pp. 89. 2s. 6d.

This is a chatty little book in which the author recounts various interesting incidents and impressions of an Army life that commenced over sixty years ago, and was evidently spent mostly in Gibraltar, Burma and

India. The subjects vary from a description of Spanish opera to a recital of the sorrows of life in a lonely Indian station. They make quite interesting reading, especially to those who are familiar with the parts of the world with which they are connected.

Correspondence.

CLOVER AND MALARIA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—There has recently been a considerable amount of discussion in the medical press of different countries on the value of certain species of *Meliolotus* (clover) in the prevention of malaria by the action of its glucoside on the parasites in the mosquito.

It would be very interesting if some investigation on sound scientific lines by hygiene specialists, or other officers of the Corps, could be made in regard to the value of this method of prevention.

Before commencing the experiments, may I advise them to read "Clover and Malaria," by F. D'Herelle, in the September number of *The American Journal of Hygiene* for 1932.

The War Office,
*Whitehall, S.W.*1.
October 10, 1932.

I am, etc.,
P. H. HENDERSON,
Major-General, Director of Hygiene.

VACCINE PROPHYLAXIS OF THE COMMON COLD AND INFLUENZA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—At this season when vaccination against colds and influenza is being done on an extensive scale we ought to be quite clear as to what we can expect from such inoculations. Dochez and his collaborators have proved by conclusive experiments on apes, repeated and confirmed by human experiment, that the infecting agent of the common cold is a filter-passing virus and they have cultivated this virus.

The infecting agent in influenza has not yet been determined, but it also is probably a similar virus.

These two diseases when they attack an individual provide him with a very transient immunity as most people know from personal experience. The vaccine used for prophylaxis does not contain the infecting agent of either disease and it cannot, therefore, produce a specific immunity. It contains the secondary organisms which invade the tissues made more susceptible by the primary cause and we can, therefore, expect it to produce some immunity against these organisms. It cannot be expected to reduce the attack rate, but it can be expected to reduce the length and severity of the subsequent illness.

The best proof of its efficacy would be to have approximately equal attack rates in the inoculated and the uninoculated with a higher rate of severe and prolonged cases in the uninoculated. For this reason even the mildest coryza should be recorded with the greatest care in both inoculated and uninoculated by those responsible for the collection of statistics.

If we ever have a vaccine containing the specific antigen for these two diseases it is extremely doubtful whether the immunity produced will last longer than a month.

Leishman Laboratory,
Aldershot.
October 14, 1932.

I am, etc.,
A. Hood,
Major, R.A.M.C.

Notices.

REPORT ON THE WORK OF THE PERMANENT COMMITTEE OF THE INTERNATIONAL CONGRESSES OF MILITARY MEDICINE AND PHARMACY, 1931-32.

International Office for Military Medical Information.

The Permanent Committee of the International Congresses of Military Medicine and Pharmacy held a second session of the International Office for Military Medical Information at Liége. It was attended by 219 members representing twenty-eight nations and distributed as follows:—

Germany 1, Belgium 110, Brazil 1, Chile 1, Colombia 1, Spain 8, U.S.A. 3, France 49, Great Britain 1, Hungary 1, Dutch East Indies 1, Italy 2, Japan 1, Lithuania 1, Luxemburg 1, Morocco 1, Mexico 1, Monaco 1, Netherlands 12, Persia 1, Poland 2, Portugal 1, Roumania 1, Switzerland 4, Czechoslovakia 1, Turkey 3, Venezuela 3, Jugoslavia 2.

Official delegates of twenty different nations had been appointed by their respective Governments.

The following subjects were dealt with by fifteen lecturers representing nine different countries :—

Physical training in the Army.
Fitness for Military Service of men suffering from spina bifida.
Anti-diphtheritic injections in the Army.
Present-day treatment of respiratory syncope.
Military medicine throughout the ages.
Pathogenic aspergilli.
Modern ideas on gymnastics.
Scorbutus (scurvy) in the Army.
The first field dressing : its qualities and methods of examination.
The role of Inland Waterways in the Medical Service in War.
Peculiarities of the Medical Service in the Militia.

Medical inspection of recruits before and after Military Service.

The role of bacteriological laboratories in the field army.

Principles for the provision of hospital accommodation in the organization of the Medical Service in the field.

Field chemical laboratories, their relation to the Pharmaceutical Service and their importance in open and position warfare.

Suggestions for a field medical card.

Contribution to the treatment of streptococcal diseases.

(2) During this session of the office the following motion was put and received the full attention of the Permanent Committee :—

"The assembly of officers of the Medical Services of twenty-eight nations assembled at Liége on the occasion of the second session of the International Office for Military Medical information, put the following motion" :—

"With a view to ensuring adequate hospital accommodation and treatment of the sick and wounded in time of war, it is advisable that certain localities should be reserved for the Medical Service to the exclusion of all organizations of a military character, and that such localities should enjoy the immunity conferred by the Geneva Convention. The Permanent Committee of the International Congresses of Military Medicine and Pharmacy is requested to transmit this motion."

It will form the subject of an investigation instituted by the Committee and of a debate at the Congress at Madrid.

(3) Certain suggestions which deserved to be immediately adopted were submitted. They included :—

(*a*) The creation of collections of military and medical studies.

(*b*) The organization of international information.

(4) Ten thousand files have been opened for the purpose of providing military medical information. Their classification is based on the following principles :—

(1) Organization and functioning of the Medical Service.

(2) Medical Service in the field.

(3) Medical science applied to Army Medical Services.

(4) Medical science proper.

(5) Medical Service in relation to civil organizations.

(6) Historical record of the Medical Service.

(7) Congresses, Lectures.

Co-ordination between Organizations.

The Permanent Committee has decided to redraft and publish its Statutes and to communicate them to all the international organizations and Medical Services of the Armies, Navies, and Air Forces.

INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND PHARMACY.

To be held at Madrid, May 29 to June 4, 1933.

The following subjects will be discussed:—

(1) The general principles affecting the military organization of a nation in case of war: the application in the various zones of the prescriptions of the new Geneva Convention.

Papers presented by Spain and Sweden.

(2) Preventive inoculation in the Naval, Military and Air Services.

Papers presented by Spain, Great Britain and Japan.

(3) The treatment of the more urgent surgical cases in the front area during war of movement. Consideration of a specialized unit—its organization and tactical employment.

Papers presented by Spain and Belgium.

(4) The preserved foods forming part of the rations issued in the services in peace and war; the mode of preparation and analysis.

Papers presented by Spain and Switzerland.

(5) A comparative study of the organization in the different military services as regards: (*a*) Dental services; (*b*) administrative services.

Papers presented by Spain, Mexico and Paraguay.

Membership of the Congress.

In addition to official delegates, all medical officers, pharmacists, dental surgeons and administrative officers serving in, or who have served in, the Navy, Army, or Royal Air Force, are eligible to attend the Congress.

As a special case, veterinary officers are also eligible in this instance.

Subscription.—Members, 30 pesetas; wives and children, 20 pesetas; students, 15 pesetas.

This subscription entitles the subscriber to all official publications, and to take part in all the receptions organized by the Congress Committee.

Payment of the subscription may be made direct to the Treasury of the Congress (Ministry of Marine) by international money order or traveller's cheque, or to the current account of the Congress at the Banca Mercantil e Industrial at Madrid.

As soon as payment is made a Congress Ticket will be issued. This must be presented to Messrs. Thomas Cook and Son (Wagons-Lits), to obtain reduced rates by rail, sea, or air.

It is advisable to make application as early as possible, as the lists will be definitely closed on April 1, 1933.

Uniform.

Military members of the Congress are advised to wear uniform at the fêtes and receptions.

Receptions, Fêtes and Excursions.

Numerous fêtes will be held during the period of the Congress, including open-air dances and bull fights.

Excursions on exceptionally favourable terms will be arranged for visits to Toledo, Segovia, Alcala, Aranjuez, and to the Escurial.

Without any material change of route or increase of the cost of tickets, arrangements are being made to enable the most interesting Spanish towns to be visited, both on the outward and on the return journey.

Ladies' Committee.

The Ladies' Committee are organizing a series of visits and demonstrations to enable wives of members of the Congress to get an idea of social and intellectual developments in Spain.

A series of talks will be given by distinguished Spanish ladies, who will be glad to receive the impressions of any ladies who care to make these known.

Arrangements for Travel and Accommodation.

Messrs. Thos. Cook and Son (Wagons-Lits) will arrange for accommodation and for the issue of the special tickets at reduced fares for travel by rail, sea, or air.

They will also arrange for the issue of tickets for the excursions in advance, so as to reduce the amount of money necessary to be carried.

It is recommended that traveller's cheques should be used to avoid the necessity of changing money in the various countries.

It is advisable to secure accommodation in advance.

A special information service is being arranged. Officials wearing a yellow brassard with the inscription "VII International Congress of Military Medicine and Pharmacy" will be present at frontier stations and in the various stations in Madrid.

Album.

An Album containing an account of the work of the Congress and of the various ceremonies, together with photographs of members of the Congress, will be prepared. This should prove a most interesting souvenir. Members of the Congress are requested to send along with their inscription form to the Commissariat General of the Congress, Ministry of Marine, Madrid, a photograph with a minimum dimension of the head of 1¼ inches.

The album will contain photographs of the Presidents of Honour and of the Permanent Committee.

The photographs of delegates and their wives, grouped by countries, will be shown, together with a table showing the badges of military medical officers and pharmacists of all countries.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—" The Editor, Journal of the Royal Army Medical Corps, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the Journal of the Royal Army Medical Corps is £1 payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

Communications in regard to subscriptions, change of address, etc., should be addressed "The Manager, Journal of the Royal Army Medical Corps, A.M.D.2, War Office, Whitehall, London, S.W. 1."

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LIEUTENANT-COLONEL A. DAWSON, R.A.M.C.

MANAGER.

MAJOR J. M. MACFIE, M.C., R.A.M.C.

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Journal
of the
Royal Army Medical Corps.

Original Communications.

INVESTIGATIONS INTO CASES OF CEREBROSPINAL FEVER IN THE NORTHERN COMMAND OF THE ARMY DURING 1931, CONCLUDING WITH A PLEA FOR THE EARLY DIAGNOSIS OF THE DISEASE.[1]

By MAJOR W. WALKER, M.C.,
Royal Army Medical Corps.

CONTENTS.

[1] Thesis submitted for the M.D. degree, Aberdeen University, and printed by permission of the Senate of the University.

In a record of this type of investigation, many problems, other than bacteriological, must necessarily be included in order to complete the picture as a whole. Thus, purely clinical considerations and problems within the realms of hygiene have been discussed as they have appeared to the investigator.

Administrative Considerations.

Area Involved.

The Northern Command of the Army comprises, briefly, the counties of Northumberland, Durham, Yorkshire and the North Midlands down to and including Leicestershire. The chief military centres are at York, Catterick, Lichfield and Newcastle-on-Tyne, with Command Headquarters at York. The greatest concentration of troops is at Catterick. There are some ten depots, for the reception and training of recruits, scattered throughout this area.

Command Pathology Services.

During the period under review this service consisted of a pathologist, styled the Deputy Assistant Director of Pathology, who acted in an advisory capacity in matters pathological to the Deputy Director of Medical Services of the Command and also functioned as Officer in Charge of the Command Laboratory at York. He had two trained men from the ranks of the R.A.M.C. as laboratory assistants. There was also a laboratory at the Military Hospital, Catterick, with one assistant, but during this period no specialist in pathology was posted there for duty. The investigations detailed below were carried out by me in the capacity of Command Pathologist.

Procedure.

The procedure laid down in regulations on the subject,[1] in the event of the disease occurring among the troops, is briefly as follows :—

I. *Action to be taken by the officer in medical charge of troops.*

(1) He will telephone or telegraph at once giving the patient's name, number, etc., to : (*a*) The pathologist in charge of the laboratory allotted to the area ; (*b*) the A.D. or D.A.D. Pathology of the Command or District.

[In this instance (*a*) and (*b*) are one and the same person.]

(2) Make arrangements for the isolation and treatment of the case and for the isolation of contacts pending the arrival of the pathologist.

II. *Action to be taken by the pathologist.*

The pathologist, on being notified, will proceed at once to the case, and later to the contacts, to investigate and advise in regard to diagnosis and treatment. The regulations further state :—

---

[1] Memorandum on Cerebrospinal Fever among Troops, The War Office, London, 1932, pp. 3 and 4.

"Clinically, the pathologist should be in early and sustained touch with the case throughout the course of the illness. Medical officers will, therefore, give him every assistance for this purpose and for bacteriological observations. In order to avoid any misunderstanding on this point, it is important to note that the pathologist is concerned not only with the diagnosis of the disease as it occurs in the patient and with the question of infectivity of contacts, but should also be afforded opportunity to study the progress of the case and to obtain material from the patient and contacts for investigation."

Local Policy.

The existing policy in the Command was to transfer the cases to the nearest civil infectious diseases hospital immediately the diagnosis of cerebrospinal fever was established. The pathologist, therefore, confined his attention to the diagnosis of the cases, the investigation of the contacts and the supervision of the carriers.

Problems of Distance.

In these investigations, the pathologist, with the necessary laboratory equipment, had to travel considerable distances, which fact precluded him from paying sustained visits to cases once material had been removed for cultural purposes. His objective then was to get back to his laboratory while the cultures were yet alive. Some of the distances to be covered were: York to Catterick, 45 miles; York to Newcastle, 85 miles; York to Lichfield, 120 miles. In the execution of these investigations it is estimated that over 3,600 miles were covered by road. The circumstances were such that, when the infecting organism was not recovered from material removed at the diagnostic visit, no other opportunities for future attempts were possible. For this reason the bacteriological results are not complete in all cases.

Factors leading up to the Outbreak.

During recent years there had been only odd sporadic cases of the disease in the Command. In 1928 no case occurred, in 1929 one case occurred at Catterick and, in the following year, there was one case each at Catterick and Lichfield.

The Ministry of Health figures[1] show a progressive rise in the number of registered deaths from the disease among the civil population from 1923 onwards. During the first quarter of 1931 the notifications of the disease exceeded the total notifications for the whole of the previous year. The weekly returns issued by various Medical Officers of Health within the Command area showed a sharp increase in cases towards the end of December, 1930, the peak being reached at the end of the following February.

---

[1] Reports on Public Health and Medical Subjects, No. 65, Ministry of Health, London, 1931.

The earlier months of 1931 had been exceptionally severe, the seasonal advent of spring weather being much delayed. A wave of influenza, of a high case incidence, but only of a moderate severity, swept the Command from the end of January onwards. This last factor may have been an important predisposing cause, but it also brought forth rigorous orders regarding precautions to be taken against the spread of disease by droplet infection in quarters, canteens and other places. The fact that, when cerebrospinal fever did appear in barracks, the disease did not assume epidemic dimensions, pays a tribute to the efficiency with which those orders were carried out.

The Occurrence of Cases.

The first case occurred in the Infantry Depot, Newcastle, on February 19, and the last case in the Infantry Barracks, Lichfield, on July 11. Below is a summary of the occurrence of cases by stations, giving dates of onset :—

Station		Number of cases		Dates of onset
Newcastle	..	1	..	February 19
Halifax	..	1	..	February 23
Catterick	..	5	..	March 3 April 4, 10, 11, 30
Strensall (near York)	..	3	..	May 21 June 12, 26
Lichfield	..	2	..	May 25 July 11

In all, therefore, 12 cases occurred in the Command. Of these, 11 were men and 1 was a child aged 9. Regarding the men, 3 were recruits, 7 were serving soldiers, 1 was a Territorial.

Age incidence (excluding the Territorial and child) ranged from 19 years to 23 years, the average being 20 years 5 months.

The length of service varied from two and a half months to five years, the average being one year eight months.

In Newcastle the case was a recruit, aged 23, with three months' service. He spent February 14 and 15 at his home near Sunderland, where cases were known to have occurred. He was admitted to the Medical Reception Station on the morning of February 19, acutely ill, and transferred to the local infectious diseases hospital on the same day as a suspected case of cerebrospinal fever. The diagnosis was confirmed, Type I meningococcus being isolated.

The remaining men in the barrack room had been in isolation for the previous three weeks as diphtheria contacts. Bed spacing was good and the ventilation of the barrack-room satisfactory. The source of infection was almost certainly from civilian carriers outside barracks.

Thirty contacts were swabbed; nine were found to be carriers (untyped), a contact carrier rate of thirty per cent. No further case occurred during the year.

In Halifax there was one case, a recruit, aged 21 years, with two and a

half months' service. He went on leave from his depot on February 14 to Keighley. On the following day he developed an influenzal-like infection and was admitted to the local general hospital. He was discharged in seven days, apparently recovered. On the 23rd, he became suddenly ill and was removed to a local infectious diseases hospital as a suspected case of cerebrospinal fever. The diagnosis was confirmed by the finding of meningococci in stained smears from the deposit of the cerebrospinal fluid. The organism was not recovered in culture. Here again the probable source of infection was outside barracks. As a precautionary measure his late immediate barrack-room contacts were swabbed. Of four men swabbed, one was found to be a carrier (untyped), a contact carrier rate of twenty-five per cent. No further case occurred.

In Catterick there were five cases: One a recruit, three serving soldiers, and one child.

Catterick Camp occupies an isolated position on open, upland country some fifteen miles south-west of Darlington. The troops are accommodated in huts which are warmed by open fireplaces, placed centrally, ventilation being effected by opening the hut windows. In this large concentration of troops there is only one unit concerned with the reception and training of recruits—the Signal Depot Battalion. In the immediate neighbourhood there are other Signal Units composed of trained soldiers. They live apart from the Depot Battalion, but they all share a common regimental institute (canteen, recreation room, grocery bar, etc.). Recently there had been a great influx of young recruits to the Depot Battalion, and there appeared to be a risk of overcrowding towards the end of February. This was averted by acquiring more living huts. The weather had been exceptionally severe and an additional issue of coal for warming purposes had been sanctioned.

On March 18, a carrier-rate estimation was undertaken, 33 men of the Signal Depot Battalion being swabbed. Of these, 16 were found to be carriers, representing a non-contact carrier rate of 48 per cent. As no attempt had been made to type the various strains isolated, for reasons given in a later section, this carrier rate can only be taken as relative.

On March 25, a case occurred in the Depot Battalion, in a recruit, aged 22, of four months' service. He occupied a hut with fifteen other recruits of like service. There was no overcrowding in the hut. A meningococcus was isolated from his cerebrospinal fluid which was at first inagglutinable, but which eventually proved to be a Type II organism. The 15 immediate contacts were swabbed and 5 proved to be carriers, a contact carrier rate of 33 per cent; 4 of the strains isolated proved to be inagglutinable, and one was a Type I meningococcus. The case had occupied a corner bed at the end of the hut far removed from the door. Of the next five adjacent beds four were occupied by the carriers of inagglutinable meningococci. The Type I carrier was further away. The disposition of the carriers pointed to barrack-room cross-infection, which,

in the absence of overcrowding, indicated defective ventilation of the room. The temptation to shut the windows, especially at night, in the face of fierce, arctic-like gales, and to stoke up the fires to their fullest capacity, was only human and this had evidently been taking place. Immediately steps were taken to ensure the adequate ventilation of huts. No further case occurred in the Depot Battalion.

The second case developed in the Military Hospital, in a man of the Leicestershire Regiment. He had been admitted to hospital on March 31, with an influenzal infection. From this he appeared to recover rapidly. During his convalescence he had his meals in the hospital dining hall and frequented the recreation room and canteen along with other convalescents, many of whom were recruits from the Depot Battalion recovering from influenza and other catarrhal conditions. On April 8 he became acutely ill and was diagnosed cerebrospinal fever, which was bacteriologically confirmed though the meningococcus was not isolated in culture. The remainder of the patients in the ward were swabbed, 40 individuals, together with all the nursing staff who had entered the ward, 2 nursing sisters and 5 nursing orderlies. One contact only was detected, a nursing orderly with a Type I or III strain. (Several meningococci isolated were agglutinated to an equal titre with two different types of serums. This is dealt with in a succeeding section.) This represents a low contact carrier rate of 3·7 per cent. The possibility of hospital ward cross-infection was very unlikely, thus leaving the dining hall and recreation room under suspicion.

The next two cases occurred on April 10 and 11, and came from different companies, widely separated, of the Signal Training Battalion. They were both very mild cases showing only an occasional meningococcus in deposits from the cerebrospinal fluid. Cultures from the cerebrospinal fluid were sterile in both cases. A Type I or III meningococcus was isolated from the nasopharynx of the second case. There was no overcrowding in either of the men's huts and the ventilation was efficient. Only the very immediate contacts were swabbed ; from the first hut a Type I or III meningococcus carrier was detected, and from the second hut a carrier of an inagglutinable strain. These men had two common meeting places, the unit dining-hall and the Signal canteen. In the dining-hall they messed at different tables, so that the possibility of a common source of cross-infection was very far removed. The canteen, common to all the Signals, recruits included, seemed the most likely place where infection could have been picked up.

The fifth and last Catterick case appeared on April 28, in the 9-year-old daughter of a corporal attached to the Signal Depot Battalion. A heavy growth of meningococci was obtained from her cerebrospinal fluid, but the organism was inagglutinable on typing. The contacts consisted of the parents and four younger daughters. Both parents were carriers of inagglutinable strains, the mother producing a pure plate culture. The source of infection is fairly evident in this case.

The sequence of events can be readily followed but, unfortunately, bacteriological proof is lacking in many links of the chain. The original case occurred in a recruit depot, which had been receiving a great influx of young lads from a civil population known to have a greatly increasing incidence of cerebrospinal fever. The case occurred in a hut occupied by recruits of four months' service. At least two types of meningococci were demonstrated, a Type II, at first inagglutinable, and one Type I from the patient, and four inagglutinables from the carriers. The circumstances suggested an immediate barrack room cross-infection, but as these men had been living under identical barrack-room conditions for four months, it is probable that the particular strain infecting the susceptible case had been introduced recently into their midst from cross-infection in the unit's common meeting place, the canteen. The two Training Battalion cases also met there. Many individuals were admitted from that locality to the Military Hospital, carrying their catarrhal infections with them. There, in their convalescence, they foregathered in the hospital recreation room and passed on their organisms to an unfortunate, susceptible individual. The child was also infected from the same source, indirectly by her soldier father.

In Strensall there were three cases, two serving soldiers and one Territorial.

Strensall Camp is situated on the edge of moorland, some six miles north of York. The 2nd Battn. The West Yorkshire Regiment was stationed there. The men were comfortably quartered in huts, in which both the accommodation and ventilation are ample. There is the usual regimental institute and, in addition, there is a small restaurant just beyond the camp limits, which specializes in late suppers for the troops. To the north of the permanent camp there is open ground prepared for the reception of tented camps.

On May 7, the 1st Battn. The Durham Light Infantry arrived from Catterick, and went into camp on the prepared site. Both units had been free from cases of cerebrospinal fever. On the night of May 21/22, a man of the D.L.I., occupying a bell tent with five other men, became suddenly ill. He did not report sick until next night, when he was immediately removed to the Military Hospital, York. Here a heavy growth of an inagglutinable meningococcus was isolated from his cerebrospinal fluid. Of the five other occupants of the tent, four were found to be carriers, two of practically pure cultures, a contact carrier rate of eighty per cent.

A detachment of eighteen men of the 8th Battn. The West Yorkshire Regiment (T.A.) arrived on a course of instruction on June 6, and was accommodated in a hut within the permanent camp. On June 12 one of these men became acutely ill and was removed to hospital and diagnosed cerebrospinal fever on clinical grounds. There was no question of overcrowding or deficient ventilation. The remaining occupants of the hut were swabbed and showed an untyped contact carrier rate of twenty-three per cent.

Fourteen days later a bandsman of the West Yorks, occupying a hut with twenty-two other men, was removed to hospital with symptoms suggestive of meningococcus meningitis. A Type I meningococcus was isolated from his cerebrospinal fluid. Again there was no fault to find with the bed spacing or ventilation. A contact carrier rate (untyped) of twenty-seven per cent was found among the remaining occupants of the hut.

The scattered nature of the cases and the high contact carrier rates pointed to communal overcrowding which, in the face of good hygienic conditions in barrack rooms, indicated a common source of cross-infection elsewhere. The canteen and the small civilian restaurant fell under suspicion. It was recommended that the canteen and the restaurant be closed down for three or four weeks, and that open marquees be substituted. This was immediately done. No other case occurred during the year.

In Lichfield there were two cases. The first case occurred in a man who on arrival from Egypt proceeded to his home in Coventry. Ten days later he was taken acutely ill and in a week became unconscious. He was eventually sent to the Military Hospital in a moribund condition. A Type I meningococcus was isolated from thick pus-like cerebrospinal fluid. The infection was, of course, contracted from civilian sources.

The other case, a private, aged 22, with four years' service, was taken suddenly ill in a barrack room within the Infantry Barracks. His cerebrospinal fluid was teeming with pus cells and many Gram-negative diplococci were seen. In my absence no cultures were taken. There were twenty-three barrack-room contacts who showed a contact carrier rate of seventeen per cent. The source of infection was never traced in this case.

Future Preventive Measures Indicated.

In what way can we apply the knowledge acquired as a result of the Catterick and Strensall experiences, to deal with future situations of a similar nature?

(*a*) *A Catterick Situation.*—(1) When cerebrospinal fever is prevalent elsewhere, estimate the meningococcus carrier rate periodically in a community especially liable to infection.

(2) If the carrier rate is found to be dangerously high (over twenty per cent) do a thorough overhaul of the bed spacing. If this is satisfactory concentrate on the ventilation of barrack rooms, particularly the night ventilation.

(3) Should the carrier rate remain high, in spite of the above efforts, attention should be directed to recreation rooms, canteens and other places where men are known to congregate in large numbers.

(4) When the bacteriological investigations point to cross-infections in regimental institutes, these should be closed down for a period of three or four weeks and canteens in open marquees substituted. In this way the

chain of cross-infection will be broken, and the great majority of carriers revert to a non-carrier state.

(5) Patients admitted to hospital from an infected unit, or a unit known to have a dangerously high carrier rate, should be kept apart from the other patients during the whole of their sojourn in hospital.

(6) Keep a bacteriological control of soldier fathers of families belonging to infected units. Limit their activities to out-door duties. If found to be carriers, isolate them away from their homes.

(*b*) *A Strensall Situation.*—When a second case occurs under similar circumstances, the procedure would be to estimate the non-contact carrier rate in the unaffected unit or units. If this is found to be high in the face of good hygienic conditions in barrack rooms, attention must then be directed to canteens and other meeting places, closing them down temporarily, if indicated, and substituting open marquees for the more urgent needs of the men.

The question may arise of what is a safe number of men to house in ordinary bell tents in such situations. Glover,[1] who made an exhaustive study of carrier problems in the London district during the war epidemics, supplies the following answer: "The safe number would appear to be seven or eight, preferably seven, and in the London district for the last two years this has been adhered to for recruits (who undoubtedly require special spacing)."

(*To be continued.*)

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THE CAUSE AND MEANS OF PREVENTION OF TONSILLITIS, WITH SPECIAL REFERENCE TO NAVAL AND MILITARY SERVICE.

By TENAX PROPOSITI.

(*Continued from p.* 364.)

The Personal Factor.

Under this heading are included the following: racial characteristics, age, carriers, susceptibility and immunity, and individual characteristics.

(1) *Racial Characteristics.*—Acton [38] reported on an epidemic of sore throat among troops in Mesopotamia. He concluded that Indian troops were less susceptible to sore throats than British. This contention is supported by the figures for the health of the Army in 1927 when the incidence of tonsillitis among British troops in India was 32·2 per 1,000, while among Indian troops it was only 3·9 per 1,000, or one-tenth of the previous figure. From reports of the Peking Union Medical College Hospital it seems that similar figures would be obtained in China; tonsillitis does not appear to be a common disease amongst the Chinese. Both black and yellow races seem to have a high resistance to tonsillitis.

(2) *Age.*—Tonsillitis is most common about the school age.

The medical history sheets of about a thousand soldiers show that this entry is very frequently the first on the sheet at the beginning of service at the age of 17 or 18 years. Bloomfield and Felty [16] found that those without a previous history of tonsillitis showed a much lower tendency to develop it than those with such a history, and that if the age of 20 was reached without an attack it was unlikely that infection would occur in the future. It has already been noted that tonsillitis in infants under the age of 5 is unusual owing to the simplicity of the bacteriological flora.

(3) *Carriers.*—The carrier is present in every community in a percentage which varies with the surroundings and the time of the year.

Simmons and Taylor [39] examined 3,000 persons and found 56 per cent to be carriers of the hæmolytic streptococcus. Leathart [40] has shown the carrier rate is far higher in children who go to school than in those who do not. Meleney worked on the personnel of a surgical team; he has found that the carrier rate rises steadily in the winter months from 5 per cent in November and December, 10 per cent in January, February and March, to 30 per cent in April and May, and then gradually declines throughout the summer.

Ballenger [41] has stated that on a conservative estimate half the population of the temperate zone, during the winter months, are active carriers of the hæmolytic streptococcus, and that tonsillitis and similar diseases have assumed the proportions of a yearly pandemic.

Bloomfield and Felty [16] took cultures from each of their groups of two hundred nurses. Three cultures were taken from each member of the group before any infection occurred. Sixty-seven of the nurses had had previous tonsillectomy of whom nine per cent were carriers. One hundred and eight had had no operation and showed thirty-seven per cent of carriers. After the attack of tonsillitis was over the throat showed a gradual change in the bacteriology from that of the acute case to that of the chronic carrier.

With regard to the carrier rate and susceptibility among 41 carriers 2·5 per cent developed infection, and among 63 non-carriers 41 per cent became infected. Thus the carriers seemed less liable to infection; this must be due either to the presence of the streptococcus or to a degree of immunity acquired from previous attacks. In the latter case it was supposed that the nearer the last acute attack the greater would be the immunity. Actually the opposite was found to be the case. It was concluded that in so far as insusceptibility ran parallel to streptococcus carriage, such insusceptibility must depend directly on the presence of the the streptococcus. Practically every case had a history of acute tonsillitis in the past and old scarred tonsils frequently yielded a pure growth of the hæmolytic streptococcus. Of 63 non-tonsillectomized non-carriers (those with no history of tonsillitis), 17 per cent acquired tonsillitis. Of those with a previous history 62 per cent became infected.

Kirkbridge, Wheeler and West [42] have recently shown that repeated cultures are required before carriers can be regarded as free from infection. Working on convalescents from scarlet fever, five patients gave one, two, or three negative cultures, but subsequently all showed the presence of the hæmolytic streptococcus.

Glover [3] has recently found the carrier-rate of the streptococcus to vary between 36 per cent in November, 1925, and 0 per cent in October, 1926. In five schools where scarlet fever was occurring, the streptococcus carrier rate was 33 per cent, 26 per cent, 26 per cent, 36 per cent, and 33 per cent respectively.

The carrier rate must assume huge proportions at times, being accentuated by winter months, overcrowding and cinemas.

(4) *Susceptibility and Immunity*.—The mass of literature on the subject of immunity is beyond the scope of this essay. The degree of immunity varies greatly in different individuals, and at present cannot be measured. Eastern races must be born with a high degree of immunity. Dudley has recently pointed out that the evidence for this assumption is strong. In China, the conditions for spread would be ideal if there was no natural immunity. In actual practice, tonsillitis is not commonly seen.

There seem to be three important factors in the resistance to infection :—

(*a*) Tonsillectomy. This is dealt with later.

(*b*) The existence of a streptococcus carrier state. Those who are carriers do not get the disease. The probable explanation is that the mild infection acts as a form of chronic vaccination.

(*c*) "Natural" resistance. Those with a history of infection in the past show a much greater likelihood to infection than those who have not been infected. If no infection occurs below the age of 20, tonsillitis is most unusual.

(5) *Individual Characteristics.*—It is said that the modern soldier goes sick more readily than did his predecessor. This is almost certainly correct. There are two reasons why this is so. The first is that we are a C3 nation as shown by the national health reports, and, further, the lower classes have been educated to take an interest in treating themselves. Daily papers, magazines and hoardings are filled with a dreary reiteration of signs and symptoms of every disease. The suggestion of sickness is constantly being "plugged" into the average layman. The craving of the out-patient at our voluntary hospitals for a bottle of medicine is getting a serious problem. It is no wonder that the ordinary man in the street tends to go sick more often than his forbear.

The "happy" and "unhappy" ship, and the "good" and "bad" regiment are factors in the incidence of sickness which go a long way, although it is difficult to analyse them.

Finally, diathesis and tonsillitis show no connection. I have carefully looked for any definite diathesis in all recent cases, but have failed to find any connection between tonsillitis and Goldthwaite's types.

Prevention of Tonsillitis.

Having reviewed the various factors in the cause and spread of tonsillitis, what means are there of preventing it?

There are three lines of attack: (1) On the tonsil itself. (2) On the general resistance to infection. (3) On the line of spread.

(1) *On the Tonsil.*—(*a*) Tonsillectomy appears to be the most satisfactory way of preventing tonsillitis. The operation also has a most beneficial effect on the carrier rate. Van Dyke [44] finds the frequency of the hæmolytic streptococcus to be greatly reduced afterwards. Pilot and Davis [45] have put the figure at fifty per cent. Tongs [11] has given similar figures, but Rhoads and Dick [46] have emphasized that the operation must be a complete one, as they have shown that the stumps left after an incomplete removal may be more heavily infected than the original tonsil. Bloomfield and Felty [16] have shown conclusively that the operation confers protection; thirty per cent of their cases occurred in non-operated persons and only eight per cent in those who had had tonsillectomy. Removal of the tonsils also cleared up carriers.

Though there is no doubt that tonsillectomy is the most efficient way of preventing infection, it is out of the question as a preventive measure. The only indication for it is repeated attacks of acute inflammation, and even then the modern tendency is one of conservatism.

(*b*) Radiation.—Nuzum [47] has attempted to sterilize carriers by X-ray of the tonsils. The results have not been very satisfactory, only

fifty per cent of carriers being improved as a result of treatment. Even with an improvement in technique, the expense of such treatment would be too great for it to be of real practical value.

(2) *The General Resistance to Infection. Vaccines.* — Felty and Hodges have employed a polyvalent vaccine containing twenty-one strains of hæmolytic streptococci isolated from recent cases of acute tonsillitis. Three injections were given of 75, 100, and 125 millions respectively. The results were good. Ninety women students were used in the experiment. No previous operation had been performed. Thirty-three were carriers; of these, 17 were vaccinated, and 16 used as controls; 57 were non-carriers of whom 18 were vaccinated. No cases occurred among the carriers, vaccinated or not. This result was anticipated in view of the previous data. Of the non-carriers, fifteen acquired tonsillitis; all of these but one were severe cases and in the unvaccinated group. Only three cases occurred in the vaccinated group, all of which were very mild and would not have reported sick had it not been for special instructions.

Robert [48] has obtained good results, but Glover [3] has not. Both employed mixed vaccines.

The objection to vaccines is the difficulty of persuading men to submit to injection for what is a comparatively mild complaint. I do not think it likely that much can be done in this way, assuming that a really satisfactory vaccine can be prepared.

(3) *The Spread of Infection.*—The collective sterilization of mess-kits is in its infancy. In spite of the interest which has been aroused, it does not seem likely that very striking results will be obtained. Infection probably takes place far more frequently in the cinema, the café and the bar.

Glover has recently emphasized the importance of preventing infected boys from returning to school, and the isolation of all pyrexias. He further advises against work being carried out before breakfast during the first few weeks of term. In the Army, it is easy to isolate pyrexias, but so much of the work of the recruit is carried out before breakfast that it would be difficult to alter the training syllabus. The age of the recruit is generally higher than that of the schoolboy, and he is more resistant to infection.

Spacing of beds remains of fundamental importance and co-operation with the Royal Engineers is essential.

In conclusion, it must be remembered that the control of the soldier ceases as soon as he leaves barracks. Our barracks have been improved as far as possible. If men were confined to barracks, the problem of the spread of tonsillitis would be a comparatively simple one. As it is, most of the preventive measures taken are rendered valueless; the only one thing that keeps the average soldier in barracks at night is lack of funds. Mechanical sterilization of utensils will enjoy a popular vogue, but the results will probably be disappointing.

The points of this essay may be summarized as follows:—

(1) Tonsillitis is due to the hæmolytic streptococcus.

(2) The incidence of tonsillitis is remarkably constant in all large communities.

(3) The infection is spread through carriers.

(4) The carrier rate may rise to 40 per cent, or even 50 per cent, under suitable conditions.

(5) Prolonged and intimate contact is necessary for transmission to occur.

(6) The cinema, café, and bar are the most probable centres of infection so far as the soldier is concerned.

(7) Adequate spacing of beds is of fundamental importance.

(8) Climatic conditions have little effect on the number of cases.

(9) Satisfactory housing is of considerable importance.

(10) Spread by infected table-ware is probably of the greatest importance.

(11) Finance is a big factor against the introduction of collective sterilization.

(12) The white races have a much greater susceptibility to acute tonsillar infections than the black or yellow races.

(13) A large proportion of individuals have a natural resistance to infection.

(14) Tonsillectomy is the most efficient way of preventing tonsillitis and in clearing up carriers.

(15) Vaccines have generally been disappointing.

(16) The problem can be attacked by only three measures :—

(i) Adequate spacing of beds.
(ii) The isolation of cases.
(iii) The sterilization of table-ware in canteens.

In this review of the problem I have drawn freely from many authors. As far as possible all references have been verified and I am grateful to the staff of the Peking Union Medical College Hospital for permission to use their library for the purposes of reference.

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MEDICAL TREATMENT OF GASTRIC AND DUODENAL ULCERS AND POST-ULCER REGIME.[1]

By Major J. BRYAN FOTHERINGHAM,
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It is only within the past few years that surgeons and physicians have begun to agree about the treatment of gastric and duodenal ulcers. Agreement regarding the methods of treatment, whether surgical or medical or both, is still not general. The physician is inclined naturally to be biased by the numerous surgical failures he sees, and the surgeon equally so because he meets so many medical failures. The trouble is that many of the ulcer cases which reach the surgeon have never received adequate medical treatment, followed by a strict post-ulcer regime—the medical failures. Again, many simple ulcer cases are operated on by the surgeon which could readily have been cured by ADEQUATE medical treatment, and which would have remained cured by ADEQUATE post-ulcer regime. I am purposely laying stress on the word "adequate" with reference to medical treatment and post-ulcer regime, because unless both are adequate one cannot expect satisfactory results. I think most surgeons and physicians now agree that gastric and duodenal ulcers are primarily medical diseases, and should be treated medically. More accurate and earlier diagnosis of these ulcers, with early and thorough medical treatment and a good post-ulcer mode of living, would cure most cases of early ulcer and prevent their recurrence. By early diagnosis and early medical treatment we would prevent the formation of old thickened ulcers which in most cases have to be handed over to the surgeon. The age of an ulcer is always important; so, too, are the questions of duration of symptoms, previous "cures"—surgical or medical or both—the type and length of previous treatment if any, and whether the patient was instructed in, and whether he carried out, any regime to prevent a possible recurrence.

As regards both diagnosis and treatment, R.A.M.C. officers are in a much more advantageous position in many ways than the general practitioner. Radiological and laboratory investigations can be carried out in most stations at home or abroad, and because of expense to the patients, etc., the general practitioner naturally cannot make use of these methods with the same freedom. I am not suggesting that the ordinary cases of dyspepsia seen at the Medical Inspection Rooms, and which readily yield to ol. ricini, bismuth and soda and relative starvation, should be admitted as a routine for such investigations.

It is generally agreed that if a gastric or duodenal ulcer has been

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[1] A Paper read in February, 1932, to Officers of the Army Medical Services, Aldershot Command.

untreated, or inadequately treated medically for five years, a permanent cure by medical means is improbable. Obviously then, the medical treatment must be early, adequate, and systematic, if "cures" by medical means are to be common.

Before commencing to give details of modern medical treatment of gastric and duodenal ulcers, it is as well to mention the types of ulcer which must, or should be, handed over to the surgeons.

Operation should be advised for [1]:—

(1) Perforated gastric or duodenal ulcers, and obviously as early as possible.

(2) Pyloric obstruction without symptoms of active ulceration.

(3) Pyloric obstruction, with symptoms of active ulceration, which is still found to be present after three weeks of medical treatment.

(4) Gastric ulcer causing organic hour-glass contraction sufficiently severe to produce six-hour stasis in the proximal segment.

(5) Recurrent cases which have not yielded to thorough medical treatment, including removal of all septic foci, and to post-ulcer régime. Frequently this means old and thickened ulcers.

(6) Occasionally, for cases of severe recurrent hæmatemesis, particularly in oldish people with sclerotic vessels which cannot contract.

(7) Cases in which pain, tenderness and occult blood in the stools are present after treatment, and where the history, age, etc., make carcinoma ventriculi a possibility.

(8) Cases of long duration with no benefit from medical treatment.

(9) Relapses within twelve months of adequate medical treatment, but not necessarily if the relapse occurred two to three years after such treatment.

To turn for a moment to statistics on ulcer cases dealt with surgically, and quoting from Taylor's "Practice of Medicine" [2] on the sequelæ of gastro-jejunostomy carried out for gastric or duodenal ulcer: "Out of 108 cases operated on at Guy's Hospital between 1910 and 1915, 65 per cent were cured or much improved seven years later, and 35 per cent were unsatisfactory." I should like you to bear in mind the 35 per cent of unsatisfactory cases.

Within the past year or two, Lord Moynihan [3] and other distinguished surgeons have strongly supported the statement that "*no case of gastric or duodenal ulcer should be handed over to the surgeon unless it has been proved incurable by medical means.*"

Recently Lord Moynihan [4] stated that the number of cases of gastric and duodenal ulcer coming under his own care for surgical treatment in which a really adequate medical treatment had been prescribed and honourably observed was very small. He also again pointed out the importance of medical treatment after operation.

The question of medical treatment and post-ulcer regime after operative treatment for these ulcers is a very important one, and one which many

surgeons now appreciate. Perhaps "many surgeons" should read "most surgeons," but this I am unable to vouch for. In the past six years I have met more surgical than medical failures, and in the examples which I will give later it is suggested that these surgical failures were due mainly to two factors :—

(1) Failure to educate the post-operation ulcer patients thoroughly in how to prevent a recurrence.

(2) Failure of these patients to carry out the instruction given them on this matter.

Perhaps the surgeons present can tell us of other reasons for such surgical failures, but I feel confident that the two factors mentioned are the most important ones. I consider that all cases of gastric and duodenal ulcer which are operated on should, when convalescent, be handed over to the physician before leaving hospital for a short course of medical treatment and post-ulcer regime instruction. Apart from other reasons, the average patient will pay more attention to a physician, or even to a general duty officer like myself, than to a surgeon when it comes to dealing with diets and drugs !

Before going into details of medical treatment, it is perhaps as well to remember what the objects of the present-day medical treatment are. They are : (1) To reduce the secretion of gastric juice as much as possible, and (2) to neutralize the hydrochloric acid in the stomach day and night. As regards medical treatment, I am more conversant with Hurst's methods than with any other. Hurst's treatment of gastric and duodenal ulcer has undergone several changes in the past ten years.

I will give first the details of his methods as practised in 1922 [5], then modifications of this treatment as published in the *British Medical Journal* in November, 1928 [6], further modifications shown in Price's "Medicine," 1929 [1], a simpler application of his methods which I have carried out for some years, and finally some remarks on post-ulcer regime.

As time is limited, I will omit details of the routine preliminary and EXTREMELY IMPORTANT treatment of teeth, nose and throat infections, obvious chronic appendicitis, chronic cholecystitis, chronic infections of the kidneys, and the ordinary treatment of hæmatemesis. Of course, it is clear that in many cases the eradication of septic foci cannot be the preliminary treatment.

The drugs employed are as follows :—

Sodium Citrate.—This combines with the lime in milk and prevents the rennin of the gastric juice from forming irritating clots. It is also a valuable alkali.

Emulsio Magnesiæ.—Is an aperient and an alkali. It contains five grains to the drachm of oxide of magnesia which has four times the neutralizing power of sodium bicarbonate. It has other advantages over sodium bicarbonate in giving off no CO_2 which is liable to distend the stomach, in having a mild aperient action, and in producing a very much

smaller secondary increase in secretion after the initial neutralization. Hurst considers sodium bicarbonate the most powerful stimulant of gastric juice in existence. On the other hand, "soda bic." has been successfully used by generations of medical practitioners to relieve gastric pain and discomfort, and to quote from Taylor's "Medicine" [2] "CO_2 liberated in the stomach inhibits gastric contractions, and causes eructations which relieve intra-gastric pressure. The reason soda bicarbonate relieves pain is due to the liberation of CO_2 by the acid in the stomach, and not to the fact that it is alkaline."

Olive Oil.—Inhibits the secretion of gastric juice, and is an unirritating food of high nutritive value in a concentrated form.

Atropine Sulphate.—Inhibits gastric secretion and lessens spasm.

Chalk and bismuth carbonate are alkalies which slowly neutralize HCl. The former has two and a half times and the latter one-third the neutralizing power of sodium bicarbonate.

Tribasic magnesium phosphate and tribasic calcium phosphate are the alkaline powders given in Hurst's methods of 1928 and 1929—the latter powder if the bowels are too free. He considers that they have the advantage of not giving rise to alkalosis in spite of acting as efficient alkalies in the stomach. They can be used in cases of renal insufficiency when no sodium citrate or magnesia is permissible.

There are two contra-indications to intensive alkaline treatment of ulcer cases—(1) pyloric obstruction, (2) kidney disease.

Hurst's treatment in 1922 was shortly as follows [5] :—

At 6 a.m. daily ½ ounce of bismuth carbonate shaken up in 5 to 10 ounces water was swallowed and the patient made to lie on his right side. The idea of this was to let the powder come in contact with and coat the ulcer ; 5 to 7 ounces of "citrated milk" were given hourly from 7 a.m. to 8 p.m. inclusive. "Citrated" means that to each feed 10 grains of sodium citrate dissolved in 2 drachms emulsio magnesiæ were added. These milk feeds were flavoured with tea, coffee, or cocoa, and in some cases custard, arrowroot, junket or semolina were allowed to replace four of the milk feeds. Cream 2 to 3 ounces was added to some feeds. Immediately before alternate feeds, beginning at 7 a.m., ½ oz. of olive oil was given, and before the remaining feeds 5 minims tinct. belladonnæ. Chalk and bismuth carbonate powders 10 and 30 grains well shaken up in 5 ounces of water were given half an hour after each of these hourly feeds, of which the last feed was at 8 p.m., and again at 9, 9.30 and 10 p.m.

At 11 p.m. the stomach was completely emptied by a Senoran's evacuator, and at least $\frac{1}{50}$ grain of atropine sulph. injected subcutaneously. No smoking was allowed during the strict treatment.

This strict treatment was carried out until for three weeks the patient had been free of spontaneous pain, tenderness and occult blood in the stools, and the X-rays showed no evidence of active ulceration. The patient's diet was then gradually increased and the alkaline powders gradually reduced.

The after-treatment consisted of taking these powders for long periods, and of carrying out a post-ulcer regime as regards diet and mode of living.

As one observer said about this particular "Hurst's method," "the results are good as regards healing, but the treatment is a strain on both patient and attendants." Having tried to make patients carry out this strict treatment, I certainly endorse that statement.

In November, 1928, modifications of these methods were published by Hurst [6] in the *British Medical Journal* in two appendices. Appendix No. 1 dealt with diet and treatment. Appendix No. 2 is similar to the "Instructions how to prevent the recurrence of symptoms" shown in R.A.M.C. Training, 1925—but not identical in its details.

R.A.M.C. TRAINING, 1925. AMENDMENT (PARAGRAPH 914g). PUBLISHED SEPTEMBER 14, 1926.

Instructions How to Prevent the Recurrence of Symptoms.

Avoid alcohol in every form.

Avoid all pips and skins of fruit (whether raw, cooked or in jam, and currants, raisins and lemon peel in cake), nuts and all unripe fruit. For example, an orange may be sucked but not eaten. Currants, raisins and figs are particularly undesirable.

Avoid all raw vegetables, whether taken alone (celery, watercress), or in pickles or salad; green vegetables must be passed through a sieve and mixed with butter. Porridge is only allowed if made with finest oatmeal.

Avoid vinegar, lemon juice, sour fruit; pepper, mustard, curry, chutney, excess of salt; new bread; tough meat, salted fish or meat; pork; clear or thick meat soup.

Take plenty of butter, and a tablespoonful of olive oil before each meal.

Eat slowly and chew very thoroughly.

Do not smoke excessively. No smoking at all if any indigestion is present.

Have some food in the middle of the morning and on going to bed, and if you wake during the night. (For duodenal ulcer only).

Have your teeth attended to regularly every six months.

Take no drugs in tablet form and no pills.

If you have the slightest return of symptoms, go to bed for a few days, on a milk diet, and do not wait for the symptoms to get serious.

Hurst's Appendix No. 1 was on the lines of the 1922 dietetic and medicinal treatment with the following main differences: Feeds were still given hourly, but from 8 a.m. to 10 p.m. Olive oil was reduced to three times a day. The hypodermic of atropine and the tinct. belladonnæ were omitted, and atropine sulphate $\frac{1}{200}$ grain in water before the 8 a.m. and 3 p.m. feeds and $\frac{1}{100}$ grain before the 10 p.m. feed were added. Sodium citrate was increased from 10 grains to 15 grains. Chalk and bismuth carbonate

powders were replaced by tribasic magnesium or calcium phosphate, and reduced to three powders per diem, with extra powders during the day or night if any indigestion or heartburn occurred. There was no mention of emptying the stomach at 11 p.m.

From this it is certain that the patients and attendants were having an easier time of it, and one wonders if Hurst's earlier method of very intensive alkaline treatment on Sippy's lines had led to cases of alkalosis.

The latest modifications of Hurst's treatment which I can find are taken from Price's "Practice of Medicine," third edition, 1929. From this it appears that the gastric and duodenal ulcer patients are having slightly more rigorous treatment than that shown in the November, 1928, Appendix. I have made out a dietetic and treatment list on these lines, but Price's book does not make it clear whether these feeds are hourly or two-hourly. From this chart you will see that: olive oil has been increased to four times daily instead of three, atropine is raised to four times daily at least, the sodium citrate is back to the original ten grains, tribasic magnesium or calcium phosphate is increased from three to a minimum of five times daily, and the stomach is again emptied at 11 p.m. by the Senoran's evacuator.

This strict treatment is continued for three weeks until the patient has had no spontaneous pain, no trace of tenderness, no occult blood in the stools and the X-rays no longer show the presence of an ulcer crater. After this the diet is rapidly raised.

Hurst considers that minced meat should be avoided, as the patient should be taught the importance of chewing his food so thoroughly that it is fluid in consistence by the time he swallows it. This has the further advantage that the food is mixed with a sufficient quantity of alkaline saliva.

He states regarding "post-ulcer regime": "He should remain strictly on this regime until he has been free of symptoms for two years, and then should follow it in a modified form for the rest of his life"; and again, "After any operation for gastric or duodenal ulcer, the patient should follow out exactly the same after-treatment as he does after medical treatment, or various ill effects, the most serious of which is the production of a gastro-jejunal or jejunal ulcer, may ensue."

For the past six years I have treated cases of gastric and duodenal ulcer on Hurst's lines, and since 1928 have followed, with a few modifications, more or less the 1928 treatment shown in the *British Medical Journal.* An example of this is shown in the table on page 422, and the following are some of the details.

I treat hæmatemesis, if present, with a liberal use of morphia, the routine administration of hæmoplastin, rectal salines with glucose, ice to suck, etc. If no hæmatemes is present, I commence with two-hourly "citrated" feeds of milk alternating with Benger's Food from 6 a.m. to 10 p.m. inclusive, i.e., two-hourly and not hourly feeds. These feeds are

Treatment on Hurst's Lines for a Gastric or Duodenal Ulcer Case in say 4th or 5th Week of Treatment. Ref. Price's "Medicine," 3rd ed., p. 548 *et seq.*							A Simpler Modification which has been found Satisfactory in Many Ulcer Cases.			
Time	Size of feed in ozs.	*Feeds* to be warm or cold; not hot or iced *Note*—All milk feeds to be measured	Olive oil One table-spoonful	Sodium citras in emulsio magnesiæ *Two* tea-spoonfuls	Mist. atropine *One* teaspoonful	Alkaline powders One powder on waking	Olive oil *One* table-spoonful	Sodium citras in emulsio magnesiæ *Two* tea-spoonfuls	Mist. atropine *One* teaspoonful *Before* 6 a.m. feed	Alkaline powders To be given well shaken up in 5 oz. of water
8 a.m.	7	Milk 5 oz.; cream 2 oz.; 1 lightly poached egg; 2 Ovaltine rusks with butter and jelly	—	*In* feed	*Before* 8 a.m. feed	—	Commenced when atropine is reduced to night dose only	*In* feed	—	—
10 a.m.	7	Benger's food	*Before* 10 a.m. feed	*In* feed	—	—		*In* feed	—	—
12 noon	10	Egg and milk, 5 oz.; potato purée, 5 oz.	*Before* noon feed	*In* egg and milk feed, not in purée	—	—	*Before* noon feed	*In* egg and milk feed, not in purée	—	—
2 p.m.	7	Junket—with jelly if desired; 2 cream cracker biscuits with butter	—	—	*Before* 2 p.m. feed	1 powder ½ hr. *after* 2 p.m. feed	—	—	—	1 powder ½ hour *after* 2 p.m. feed
4 p.m.	7	Milk; 2 Ovaltine rusks with butter	*Before* 4 p.m. feed	*In* feed	—	1 powder ½ hr. *after* 4 p.m. feed	*Before* 4 p.m. feed	*In* feed	*Before* 4 p.m. feed	—
6 p.m.	7	Arrowroot or semolina with jelly if desired	—	—	*Before* 6 p.m. feed	1 powder ½ hr. *after* 6 p.m. feed	—	—	—	1 powder ½ hr. *after* 6 p.m. feed
8 p.m.	7	Benger's food; 2 cream cracker biscuits and butter	*Before* 8 p.m. feed	*In* feed	—	—	*Before* 8 p.m. feed	*In* feed	—	—
10 p.m.	7	Milk	—	*In* feed	—	—	—	*In* feed	2 teaspoonfuls *before* 10 p.m. feed	2 powders 15 min. *after* 10 p.m. feed
11 p.m.	No feed	Stomach emptied by Senoran's evacuator if instructed	—	—	2 teaspoonfuls *after* alkaline powder	1 powder *after* stomach is emptied	—	—	—	—

Note.—Additional atropine may be given if the patient can take it without unpleasant symptoms. Extra powders *should* be given if patient feels any acidity.

Note.—*First feed* at 6 a.m. (*milk*) and not 8 a.m. An extra "citrated" milk feed at night if patient awake, followed by an alkaline powder.

flavoured with tea, coffee, cocoa, or Ovaltine, and cream is added to a proportion of them. The mouth is washed out after each feed and the tongue scraped with a spatula night and morning. Atropine sulphate and olive oil are given three times a day before feeds, but I seldom start giving olive oil until after about three weeks treatment, and about the time the atropine has been reduced to the double dose before the last feed. One frequently finds even when commencing with two drachms of olive oil or less, that it nauseates the patient in a very short time. I do not care to give it too early in hæmatemesis cases, because of the danger of retching. This dislike to olive oil does not hold good when dealing with the Latin races, who are accustomed to large quantities of oil in their food. The reason I frequently reduce the atropine to the double dose at night only, after about three weeks treatment, is mainly because so many patients complain of a dry mouth when taking it. As regards the alkaline powders, I have always kept to the original chalk and bismuth powders, giving them as a minimum after the 2 p.m. and 6 p.m. feeds, and a double powder after the last feed at 10 p.m.

As regards diet, I usually add egg flips (i.e., egg and milk beaten up), potato purée, and semolina in the second or third week after the patient is free from pain, etc., the additions depending on the severity of the case. The potato purée requires constant supervision to see that it is correctly made. In fact, the whole treatment has to be closely supervised. Avoidance of constipation is important.

When the patient has been three weeks clear of epigastric pain, tenderness, and occult blood in the stools, malted rusks and butter, lightly boiled or poached eggs, steamed white fish, stewed apples, orange juice, etc., are added to the diet. I gradually get the patient on to four main meals *per diem*, with "citrated" milky feeds in between so as to keep him on two or two and a half-hourly feeds. Nearly all patients should be kept strictly in bed for the first three weeks, but some can be allowed up gradually after this time. When patients are marked "up," they are weighed weekly, and if necessary their red cell count and general blood picture are investigated. Before patients are fit to leave hospital—a very variable period—I try to educate them in their post-ulcer régime. Instructions similar to those on p. 424 are given and explained to them. They are asked to study the instructions, and to make out a diet for themselves from their hospital experience and with the help of this list. I go over the proposed diet with them with a large blue pencil, explaining "indigestible residue," etc., and amplifying the list of instructions. It is truly amazing what gross dietetic indiscretions educated people will put down in their proposed menus. When these ulcer patients have recovered, they are discharged from hospital equipped with the list of instructions on post-ulcer regime, and where possible I arrange to see them periodically. It is difficult, and sometimes impossible, for patients to carry out the regime properly. The reasons for this are generally inability on the part of an unmarried soldier

to diet satisfactorily—particularly in training periods, lack of appreciation of the necessity of post-ulcer regime when the individual feels fit and is free from gastric symptoms, and the expense of buying suitable food.

POST-ULCER REGIME—TO BE FOLLOWED PERMANENTLY.

Things not Permitted.

Smoking—Except in the strictest moderation and after meals only. No smoking if any indigestion present.

Alcohol.

Soda water or any effervescing drink.

Coffee and tea—Except as allowed in opposite column.

Lime juice or lemon juice. Ice cream.

Meat Soups—*Thick or clear, or meat extracts.*

Currants, raisins, figs, nuts, unripe fruit.

Pips and skins of fruit.

Cakes, puddings—With currants, raisins or peel in them.

Jam or marmalade—With pips, skins of fruit or peel in them.

Oranges—Unless sucked (i.e., juice only permitted).

Raw vegetables—i.e., celery, salads, watercress, pickles, etc.

Green vegetables—Unless passed through a sieve, mixed with butter, and served as purées. Spinach should be avoided.

Porridge—Unless made with the finest oatmeal and very well cooked.

Condiments—Pepper, mustard, *much* salt, chutney, curry, vinegar, etc.

Made-up dishes and sausages.

Pork, salted fish, high game, salted meat.

Tough meat, new bread, pancakes, pastry, and new potatoes.

Things to be Encouraged.

Eat slowly and chew *all* food until of a watery consistence.

Food to be taken at intervals of not more than 2½ hours from rising until bedtime, and again if awake during the night.

Rest after meals when possible.

Teeth to be seen to every six months.

No drugs in tablet form to be taken.

If you have the slightest return of symptoms "report sick," because bed, milk diet, the alkaline powders, etc., for a few days may be necessary to cut short an attack.

Take a "refresher" course of powders and lighter diet one month in every six.

Take plenty of butter and cream.

Take a tablespoonful of olive oil before each meal.

The following articles of diet are sound:—

Milk, Benger's food, Horlick's malted milk, Ovaltine, malted rusks, cream crackers and other plain biscuits, stale sponge cake and sponge fingers, stale bread, dry toast, milk puddings such as ground rice, semolina, arrowroot, etc., junket, fine oatmeal porridge, purées of potatoes, cauliflower, artichoke or parsnip, fruit jellies such as red-currant jelly, etc., creamed chicken, eggs—boiled, poached or scrambled; white fish—boiled, steamed or pounded; macaroni, vermicelli; apples—stewed; prunes—sieved and stewed.

The following may be taken occasionally or as instructed:—

Small quantities of mutton, veal, rabbit, cold boiled ham, sweetbread, tripe or chicken.

One cup of weak milky tea daily.

One cup of café-au-lait daily.

Plain chocolate.

N.B.—It is very important to avoid physical fatigue, chills, and all forms of "worry."

I think it is very important that all such patients—whether senior officers or young soldiers ear-marked for Medical Boards—should be thoroughly educated in how to avoid a recurrence. Many may consider it

a waste of time to instruct men who have little or no chance of being able to carry out their post-ulcer regime properly, but I feel it is the only fair thing to do. After all, medical officers in sanatoria always instruct phthisical patients in "post-sanatorium regime," although they know full well that many of these patients cannot hope to carry out these instructions when they return to their homes. Although I am open-minded about the Hurst method of treatment, I feel sure that close attention to a strict post-ulcer regime is a necessity, and agree with those observers who consider that it should be carried out permanently.

My reasons for giving the list of instructions from "R.A.M.C. Training," and a somewhat amplified version of this list which I made out and use in preference, are that I have found patients who consider the former difficult to read, to understand, or to memorize, and most prefer to see their "Do's" and "Don'ts" in columnar form. Apart from that, I consider the columnar list has the more appropriate heading, and it contains more advice.

The following are some typical examples of ulcer recurrences of the types we have all met:—

Patient "A."—Operated on for gastric ulcer twice (emergency suturing followed later by a gastro-enterostomy). Was told on his discharge from hospital he could now eat anything; received no post-operative medical treatment, and no instructions on how to prevent a recurrence. He is naturally disappointed when he has a recurrence, and it is found that he has an ulcer at his gastro-enterostomy opening.

Patient "B."—History of duodenal ulcer off and on for ten years. Has been "cured" by medical treatment also "off and on" during this period. Was given vague instructions how to prevent a recurrence and has followed them spasmodically. Present condition unsatisfactory.

Patient "C."—Senior naval officer. Old-standing gastric ulcer case. Operated on twice. Rarely free for any length of time from dyspepsia. Improved greatly on strict Hurst's treatment and post-ulcer regime, but not really fit three months after. Is good about diet and most of his post-ulcer regime, but will not or cannot stop smoking heavily, and is inclined to rush his meals. A great worker, who takes life very seriously and worries too much.

Patient "D."—Naval officer with a recurrence of a duodenal ulcer. Had previously been treated on Hurst's lines and semi-educated in post-ulcer regime. Is good about his regime in spasms, but is "a bit of a lad" at times, and finds dieting, etc., very difficult on board ship.

Patient "E."—Corporal, R.A.M.C. Three years history of dyspepsia and then had a gastro-enterostomy performed for a gastric ulcer. Free of all symptoms for eighteen months after operation, but made no attempt to carry out a post-ulcer regime of which he knew next to nothing. Result, that three years after operation is admitted to hospital with a very severe hæmatemesis.

Patient "F.".—A warrant officer in the Gunners, of quite average intelligence, had gastric symptoms for three months, followed by a perforated gastric ulcer which was sutured. Later a posterior gastro-enterostomy was carried out, and patient treated medically after this operation. Prior to his discharge from hospital he was given a list of instructions on how to prevent a recurrence. He carried out this regime carefully for some months and then lost his instructions. After this he gradually became less strict about his diet, and eventually had a recurrence of the old symptoms. He was admitted to hospital, and on investigation I found that for four months prior to this admission his diet had contained the following: Fried bacon and tomatoes, fried egg and bacon, roast mutton, roast lamb, roast rabbit, fried mutton cutlet, spinach, runner beans, turnips, salads whenever obtainable, tinned fruit, cold ham, and about six cups of tea *per diem*. As regards fruit, his list was as follows: The juice of oranges, bananas, apples, grapes, rhubarb, plums and strawberries. Add to this fifteen cigarettes *per diem* and a bottle of stout. For the relief of epigastric pain he usually took brandy in coffee. He did not do himself too badly for a married man with four children, but then I had him as a patient before the Snowden Budget!

Prior to getting him to write down the details of his diet for the previous few months, he informed me that he had been very careful about diet since his operation, although not quite so strict latterly. His ideas about post-ulcer regime were, to say the least, somewhat vague, and you will not be surprised when I tell you that his recurrence was an ulcer at the site of his gastro-enterostomy opening, associated with pain and tenderness in the epigastrium, and the presence of occult blood in the stools.

To sum up:—

(1) It is imperative to remove all accessible sources of infection.

(2) Gastric and duodenal ulcers are primarily medical diseases.

(3) Large quantities of alkalies and very careful dieting are required for long periods in their treatment.

(4) The diet should never be increased if any epigastric pain, tenderness, or resistance are present, but rather decreased.

(5) A good post-ulcer regime is necessary for all cases whether treated surgically, medically, or both.

(6) Ulcer patients require thorough training in this regime before leaving hospital.

(7) The post-ulcer regime should be permanent and strict, because of human nature, frailty and forgetfulness.

I am indebted to Major D. McVicker, M.C., for much help in the past in treating many cases of gastric and duodenal ulcer. My acknowledgments are also due to Colonel W. P. MacArthur, D.S.O., O.B.E., K.H.P., and Major F. Holmes, for valuable advice, and to Major-General J. A. Hartigan,

C.M.G., D.S.O., K.H.P., D.D.M.S., Aldershot Command, for permission to submit this paper for publication.

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DOWN SOUTH.

By U. P. A.

I.—The Flight from Gold.

The mail from home had been received and perused. It was not brimful of interest. I opened the *Weekly Times*, but failed to obtain any pleasure from the orange-coloured "Gazette." Georgina toyed with a letter written in thin, neat characters on a thick, creamy, crinkly sheet of imposing size.

A stray zephyr, dry and hot, blew in at the west window. Its passage drew a rustling sigh from the parched garden, and in the moonlight one could see a little shower of dead, desiccated leaves falling from the big silk cotton tree. Then, except for the hum of the overhead fan, all was still, silent and stuffy once more.

Georgina yawned: rather a loud and artificial yawn, I thought. The *Times* had a good photograph entitled: "Late Snow in the Cotswolds."

"Your Aunt Elizabeth is a tiresome creature," Georgina said. The *Times* is of opinion that, even if the Disarmament Conference has not achieved very much, still, the representatives of Great Britain, France, Germany, Chile, Egypt and Mexico now know each other better than when the conference began.

"Your Uncle James writes a better letter: just the same news in it, but not so soporific," resumed Georgina. "Besides, I prefer his notepaper; less like a parchment manuscript, tenth century; and his penmanship—what do you make of that? Aunt Elizabeth's writing is, of course, spidery: that is the only word; but Uncle James' is Burgundian, or Stiltonian—something full-flavoured and rich. Something which suggests perpetual good humour and Newmarket and the devil take the hindmost. Phew! It's hot to-night."

I folded the *Times* as deliberately and ostentatiously as possible, and laid it aside. "Aunt Elizabeth is methodical, upright and altogether virtuous," I replied—"while Uncle James is—well, hang it all, look at his flamboyant hand! Baroque, naked and unashamed."

"Yes, that is it; and Aunt Elizabeth is early Gothic—almost Perpendicular, in fact; and the older *you* become the more Elizabethan and the less Jamesian are you."

"Oho! So that is your objective, is it?"

"A Baroque husband may be something of a trial at times, I dare say:

but, on the whole, he must be vastly more entertaining than the Perpendicular variety."

"Georgina—this is what may be termed a cactus conversation. Pursued in the atmosphere of a hothouse it will, presently, develop a number of sharp and most irritating prickles. Let us adjourn to the comparative coolness of the garden."

A hand-clap, and a trio of dusky minions emerged from nowhere, spread a carpet, set chairs, switched on the lights in the trees and fetched the wherewithal to soothe and exhilarate, to soften and encourage, to bring laughter and to summon tears.

Stands Scotland where she did?

Speaking by and large, the answer is, perhaps, a tentative and rather weakly "Yes." It is certainly impossible to thunder such an answer at twelve shillings a bottle. Yes—a bottle: not a barrel.

In the midst of this musing, one of the aforesaid minions brought me the discarded copy of the *Weekly Times.* I sent him, and it, away—quickly.

Georgina scanned the creamy, crinkly notepaper and gazed at the moon, alternately. I think she sensed Aunt Elizabeth's temperament in the letter, and saw Uncle James' portrait in the planet. As a matter of fact The Man in the Moon is by no means unlike my Uncle James; and, indeed, that illustrates one of my Uncle's main characteristics: even when thousands of miles away, it is easy to recognize his cheerful countenance in all sorts of animate and inanimate objects, and to recall his memory in a melody or a mime.

Not so with Aunt Elizabeth: even close at hand she is always distant, always austere.

In saying this, I do not wish it to be inferred that a donkey or a dollop of Turkish delight could possibly be mistaken for my Uncle James. Discrimination is indicated. On the other hand, although there are a few irreverent ones who would declare that an elderly grey parrot bears a certain resemblance to Aunt Elizabeth, still, these people are either ill-conditioned or devoid of all expectation.

At this stage the literary purist might argue—and with reason—that neither Aunt Elizabeth nor Uncle James have anything to do with the subject. However, to this there are several effective rejoinders.

Firstly, I am not a purist, literary or otherwise.

Secondly, I may have been over-discursive regarding these two honoured relations but, in the first instance, I was not guilty of their introduction to these pages.

And thirdly, Uncle James spent the best part of his life building bridges in Ceylon. True, Aunt Elizabeth avers that most of these bridges were not needed, and that they have served for nothing better than the passage

of pestilential automobiles; but it must be remembered that Aunt Elizabeth's Ceylon belongs to the days of straw "boaters" and jinrickshaws.

"Thus writes your Perpendicular Aunt: h'm—— "

"My dear Georgina—I am afraid Pearl, and Potts the postman are about to make a match of it after all. It is *so* annoying because cooks do not grow like *the weeds* in the streets of this quiet village. Your Uncle James says 'Bless the girl!' but he won't be so happy about it when his eggs are fried to a *leather* and the bacon is *underdone.* We shall be lucky if we manage *satisfactorily* to replace Pearl by the time you two dear things return to England once again. How your Uncle continues to *laugh* and become *fatter* and *fatter* in face of all our misfortunes drives me *to despair* of his sensibility. This *dreadful* flight from gold, my dear, and a tariff on soap and many other personal and household *necessaries,* and the income tax *up again*—you can have *no conception* of all the *cruelties* inflicted on your poor, *suffering* native land, just because it *won* The Great War and *lost* The Great Peace. Your Uncle says we should be sympathetic since you, too, have your trials, including a ten per cent 'cut' (hateful word!) but I feel sure a comparatively unimportant deprivation such as that does not worry you. I know you will always put *patriotism* before *pocket.*

The vicar's wife has been confined to bed, poor dear, with an attack of rhomboid arthritis—or so Dr. Tavistock states though, *between you and me,* diagnosis is not his forte. *Chilblains,* brought on by the unusually severe and changeable weather, I should say.

So you have again motored from the *far* north-west into Rajputana? Dear me! why have you done this *fatiguing* and *costly* journey a second time? I find it difficult to work up *much* enthusiasm over 'the red roads of Gwalior' and 'the cotton fields of Indore.' Your Uncle says there is a *very* fine fort at Gwalior; but is it any finer than *Windsor Castle?* He also tells me that the bullock cart traffic in Indore is *amazing;* but is it more amazing than the Sunday morning exodus from London, which is propelled by petrol *past our house,* en route to Clacton?

I am sure it is not.

Do you like Poona? It used to be a great, and therefore *wicked,* horse-racing place. I hope, my dear child, you do not bet. A Calcutta Sweep ticket is *a different matter,* for it you can put in your purse, and sit quietly at home, restraining your impatience *as best you may,* until the great day when the *fateful* results are announced. By this means you avoid the *awful* contamination of *The Turf.* My husband used to tell of how he once made *Rs. 5000* by backing an outsider in the Viceroy's Cup *both ways* However, I happen to know it was only *Rs. 500.* In some respects men

are exceedingly *vain* and *imaginative*, my dear. The winnings grew with the years. But he has ceased telling the story since our present vicar—a *strong* evangelist, I am *thankful* to say—arrived here.

When we were in Ceylon we once had a *perfectly lovely* bungalow surrounded by trees. Alas! these beautiful trees were, in reality, *most* treacherous, for they sheltered the miasma of ague which, as you know, stalks abroad *by night*. Your Uncle's liver (or is it his spleen?) has never been the same since. I hope there are not many trees in Poona or, if there are, that you and my darling nephew never sit under them in the *evening* during the *hot* weather."

Again Georgina focused her gaze on the moon. The letter fluttered to the ground; but, in its descent, it turned over and, in the middle of a fair, creamy, crinkly sheet revealed what seemed to be a postscript which Georgina had missed. I picked up the sheet, read, drew a deep breath and whistled.

"I feel more like screaming than whistling!" Georgina commented.

"Look at this" I replied, and handed her the sheet. This is what she read:—

"PS.—On second thoughts I am inclined to agree with your Uncle James that, perhaps, my remarks concerning your ten per cent 'cut' (that obnoxious word again!) are not quite *practical*. I should hate to think that you have had to do without a hat, or coat, or something you *really need*; so we enclose a small cheque with our *united* and *fond* love to you both."

A hurried examination of the out-size envelope disclosed the cheque secreted in the left hand bottom corner. By the florid penmanship we knew that the cheque had been made out by Uncle James, and it was not for an insignificant amount.

"I say—your Uncle James is a brick" said Georgina in awe-struck tones.

"Yes; and so is Aunt Elizabeth," I answered no less fervently.

"No: two bricks, she is; and, with a very small addition, this will just get me that mauve silk frock and the brown jumper suit I have wanted—and needed—so much. Hello! What's amiss?"

To be sure I felt a little disappointed, and I had failed to dissemble with sufficient speed and success. No help for it: the truth had to come out. "Of course you must have the frock and suit: *c'est entendu*. I was only thinking, momentarily, of leave."

Georgina elevated her eyebrows, opened wide her eyes and exclaimed: "But can't you see—the frock and the suit settle the question. I could

not possibly go on leave without them. Now that they are as good as mine, leave follows as a matter of course."

"I confess I did not look at it from that point of view. I was thinking more of economy than of clothes. You have not forgotten about retrenchment, have you?"

"No, not yet; but I hope to forget about it as soon as possible."

"Georgina, that is a revolutionary aspiration of which I disapprove."

"Men have two outstanding traits: their utter subservience to fashion, because they are in terror of ridicule; and their blind adherence to the official, because they feel that the way of discipline is the way of safety. Hence you label my idea revolutionary. You cannot, however, class it as retrograde. To women, fashion is synonymous with change, and the official is merely the brake to progress."

"Yes, I have heard you say that—or something like it—before. Now tell me what bearing that has on the economical aspect of leave."

"To understand this problem you must begin at the beginning. I have been studying this nightmare flight from gold for some time, and I am now quite sure that you and the Frigidaire ——"

"Georgina—I protest. The Brigadier ——"

"Brigadier or Frigidaire: in this connection it's all the same thing." Georgina was now thoroughly warmed to her subject. "First of all, America and France captured three-quarters of the world's available gold and locked it up in the vaults of their banks, fearful lest anyone—even their own nationals—should handle a grain of the stuff. Then Messrs. Curry and Kirkland, and all the big bankers in Britain awoke to find that they possessed a mere quarter of the world's supply of the precious metal, so they said: 'Gold is now quite useless as a commodity. We must get rid of all we have. Let us send it to a place from whence it will never return.' So they sent it to Mittel Europa, where it was all expended in printing propagandist posters and guide books for the purpose of attracting the tourist traffic. Then Messrs. Curry, Kirkland and the rest decided that some sort of a currency was necessary; but a decision was difficult to arrive at, because America was sulky and suggested saxophones—silver ones, of course: France was in a temper and proposed coal and Scotland —not to be outdone—voted for oatmeal. By this time the bankers were at their wits' end, so dear old Mr. Volt, who used to live in a funny little house in a side street off Whitehall, was called in consultation. Mr. Volt said: 'Why not have a sterling currency?' and everybody shouted 'Why?' 'Because,' Mr. Volt replied, 'nobody will understand what it means.' This proposal was passed unanimously and with acclamation, and dear old Mr. Volt received—under confidential cover—a special vote of thanks from the Army Class at the School of Economics."

"This is the first time I have heard this piece of inner history."

"America said 'Gee!' France said it must be right because it was so logical. Russia considered that sterling would reduce the Five-Year-Plan to four, and the Frigidaire announced that it would reduce leave to vanishing point."

"Nothing of the sort. Besides, do you realize that you are infringing the King's Regulations and talking politics?"

"I'm not talking politics. I hate politics. I'm talking sense. Well—where was I? Oh, yes! so they raised the tariff and the income tax and cut us ten per cent., and we counter-attacked by retrenching. I read in the papers that we did it with a smile, but we didn't: we did it with a grin, and a grin has as wide a range as the spectrum. Anyhow, the butcher and baker and candlestick maker did not like my grin. They said: 'Memsahib—we know you cannot spend gold nowadays; but why do you not spend any sterling?' To this my answer is a grin—'*Gu-uu-rrrh!*'—and the poor fellows back out to file their petitions in bankruptcy."

"That is very sad."

"Of course it is; and what has retrenchment done for us?"

"Debit side, uneasy and uncomfortable; credit side, three rupees per mensem."

"On paper, the material result of retrenchment is a gain of three sterling rupees; but what is it in fact? or, in other words, where are those three rupees?"

"With Messrs. Curry, Kirkland and Co. I presume."

"H'm. I wonder. Would it surprise you to hear that a new ballet is being produced at the State Opera, Vienna? It seems to me that, at this rate, we shall soon be off sterling and back to bronze. In fact, it would be a very good thing if we could revert to a prehistoric state for a bit. Five million years ago Geneva was a veritable Garden of Eden—or so the medical specialist—"

"Oho! so he is the authority, is he? I thought I recognized—"

"And consider your Aunt Elizabeth and Uncle James: they see what is wrong."

"How so?"

"This cheque has a significance far beyond a mauve silk frock and a brown jumper suit. Its magic message is 'CIRCULATE!' I absolutely refuse to supply the Vienna State Opera any longer with an unending stream of sterling. Let us take our little trio of rupees and let us all circulate. And as for the Frigidaire—"

"No, not that, I beg you. The Brigadier is, as you know, a most thoughtful and sympathetic superior. After all, he is only carrying out the behests of Army Headquarters."

" What—of Simla ? "

" Certainly."

" Then that settles it, definitely. Twice we have traversed half the length of this great continent, and twice the journey has been left unfinished. Let us scatter the blessings of sterling in the sunny South. Let the journey be completed, yes, even to Trichinopoly and Tuticorin. When shall we start ? "

A fortnight after the above conversation, we set out.

By that time Trichinopoly and Tuticorin had been extended to include Trincomalee for—as Georgina said—" If it is a case of flying from gold, then for goodness sake let us do the thing properly, and fly as far as we possibly can."

II.—To Adam's Bridge.

At sunset on 5 March we sought the garden for a breath of fresh, hot air. The close of a strenuous day had seen the end of our preparations. Tired, but satisfied, we sank into a couple of Roorkhi chairs, and heralded our wants with the ancient, yet evergreen, " Koi hai ? "

The car was complete with p.o.l., water and air.

The last suitcase had been forcibly fed, and triumphantly fastened down by sheer weight of numbers.

Café and Noir had received their final instructions, and had retired to rest in view of an early start on the morrow. Not that an early start had much to do with it—as we discovered later on. The amount of rest which Café and Noir considered to be compatible with a good state of health was simply amazing.

Café was the car boy and Noir the general factotum. They were dark, diminutive juveniles of the light-weight jockey type: indeed, their physical qualifications determined their selection from amongst a number of applicants because, when the car was fully loaded, the space available in the back was negligible. This method of selection is not recommended. Frequently I was in doubt as to whether Café and Noir were looking after us, or we after them.

At 7.15 p.m. the head of a procession of cars entered the compound. The flow continued, with irregular intervals, until 8.15 p.m., when practically the whole Corps and His Wife had arrived. It is difficult to describe this impromptu reception, but an impressionistic effort may convey something of what took place—thus :—

Scrunch, grind, bang. " Just dropped in for a second to wish you good luck. Positively can't stay. You must be dead tired packing—Koi hai ? Oh, well, a ten per cent peg, thank you. Chairs ! Cigarette ? "

Scrunch, grind, bang. "Blew in to say 'Au Revoir.' You must have a lot to do yet. Won't stop, definitely. Fine weather for—Koi hai? Chairs!—and, my dear, Angèle is selling the loveliest *brasser*—thanks, a 'cut' pink gin—yes, my sacred aunt, three putts on the 13th and—" Scrunch, grind, bang. "Just came to say 'Goodbye.' No, we won't stay: you must think us a nuisance. Koi hai? Chairs and cigarettes. Well—a tariff nimbu, thank you—and as soon as he said 'Oh!' I knew it was appendicitis and—it's a scream to see her on the links, stockingless, with legs like a—durzi who sits all day on the verandah doing nothing—but drinking iced income tax. What's that? You know: Rustomji's worst brand of—jazz on a B-flat cornet, ye gods!" Honk-honk. "Can't stop—hai—matches—economy sherry, thanks. Chairs!" To-oo-ot—toot. "—wish you luck. —tired packing. —must fly. Oh-well—. —says that goldfish never eat anopheline larvæ—so now she has covered the cushions of the car with an old bedspread—and he spends all his time weeding—cheerio!"

In my too frequent moods of pessimism I am inclined to be sceptical about an elusive quality called *esprit de corps*. References to this quality are often forced: they give the impression that the wish is father to the thought. But it would be an egregious piece of self-flattery to imagine that the reason—or, at least, the chief reason—for the above gathering was anything else but a corporate expression of *In Arduis Fidelis.*

The last farewell was said at 8.45 p.m., and it seemed fitting that the officer concerned was "late R.A.M.C." Incidentally, I first met this particular officer twenty-six years ago: 26 years ago. . . . Now he is on the point of going home. Another peg uprooted: another good friend the less in the Corps: I feel lonely: I am becoming very old. Georgina laughs—thank goodness.

There are certain jobs so tiresome and difficult that none but specially gifted people can be trusted to do them properly: such jobs as working out a cross-country journey from Bradshaw, eating a large mango in public or fiddling with the electrical equipment of a motor car. At 7 a.m. on 6 March Georgina—who had not yet breakfasted—was faced with the task of transferring a pound of imported Devonshire butter from the frigidaire to the interior of a thermos. We were due to leave at 7.30 a.m.

Enter one of those specially gifted individuals, our Charles.

Charles has to his credit several claims to fame; but when it is stated that he always carries an automatic lighter which never fails to ignite, enough will have been said to show what manner of man he is.

Georgina sat down to breakfast with a comfortable sigh which, I thought, was somewhat discounted by the intent, anxious manner in which she studied our visitor. A cup of tea? A cigarette? Charles rubbed

his sleepy eyes and explained that he had just dropped in to see if he could be of any use. Georgina thanked him sweetly and said: "No: everything is ready now—except the butter; but I can pack that into the thermos in a moment." Charles, good fellow, pricked up his ears. "May I do it?" he asked.

This is not the story of how father carved the duck and hung the pictures on the floor. An eager, wideawake Charles is nothing if not efficient. He eyed the butter in a way which would have made anything else but butter shiver with apprehension. He handled the knife as an artist would a palette knife. He made an accurate mental note of the size and shape of the thermos and—like all true craftsmen—went through the motions of getting his cuffs (had he been wearing any) out of harm's way.

The butter went into the thermos as neatly, quickly and compactly as if Charles had used a grease-gun.

Georgina finished her eggs and bacon.

7.20 a.m. Café appeared on the verandah with what seemed to be an out-size potato sack, heavy and bulging. Georgina pounced on it. "What is this?" she asked. "My luggage," Café answered. "Turn it out."

Café produced a variety of articles, most of them nameless, at the rate of one per two seconds. The sack was a well stocked junk shop: a sort of marine store, Indianized. Two minutes passed and as the top layer was only half exposed to view, Georgina up-ended the thing, cast out a goodly number of the weightier articles and repacked what was left. Time: three minutes. Café did not seem to be disturbed in the slightest, and whether he missed the jettisoned gear, or not, we never discovered. However, we did find out that a Hindu's goods and chattels comprise an uncommonly weird collection of stuff.

Then Noir trotted up with his belongings. His bundle was such a small one, that there is no doubt the owner had witnessed the misfortunes of his colleague from afar, and had taken steps to ensure that his baggage would not be rummaged through by an unsympathetic memsahib.

7.30 a.m. Charles waved the butter knife—which he had previously cleaned in masterly fashion on a banana skin—and we were off. First halting-place, Belgaum, distant 212 miles.

"Off!" you exclaim: "well—you have been a long time about it."

Let me explain. I have not set out to describe the mighty river, the rugged mountain and the smiling plain. Landscape must be content with incidental mention, for a more gifted pen than mine is needed adequately to deal with the glories of Nature. Something less ambitious must suffice; and so it comes about that, while my lack of ability has compelled me to look at our wanderings through the wrong end of the telescope, yet have I tried to keep in mind the fact that Life is composed more of the lesser than of the bigger things.

A Ruskin or a Conrad is born, not made; but he must be a sorry scribe who cannot turn out something better than the literary (*sic*) products of the tourist agencies.

Then again, I do not aim at carrying the Nerbudda and the Nilgiris into the family circle: no: my object is to deceive people into forsaking the ease and comfort of home life for the chances and mischances of travel abroad, thereby proving to the world that, as the years roll on, Britons never, never will be logical, sensible folk.

If I fail, take up your Ruskin or Conrad. If I succeed, you will see for yourself what I dare not attempt to picture. Also—if you are unlucky—you may travel along the roads of the Bombay Presidency.

Having travelled from north to south and east to west on the roads of the Bombay Presidency, I now feel that I am highly qualified to act for any automobile association in need of a virile and venomous propaganda secretary.

In the Bombay Presidency you do not motor: you bump and bang, jolt and sway, inhale and swallow much fine, filthy dust, and wish you had gone by train.

It is said that the authorities wish precisely the same thing.

I believe that. I am willing to accept the meanest, the most villainous, the most unscrupulous reason which can be tendered as an excuse for the utter decrepitude of the King-Emperor's highway. So extreme is this decrepitude, that no nice, gentlemanly explanation could possibly suffice to cover it.

The Western Indian Automobile Association displays an effective poster showing the heavy financial burden imposed on motorists in India. It is a burden far heavier than that borne by motorists at home. And yet, despite "the raid on the Road Fund," and the way in which motoring has damaged the railways, the British motorist still enjoys magnificent roads.

Surely there is something wrong about all this: a failure in equitable distribution of wealth, revenue and amenities. It would be well if the W.I.A.A. were to withdraw its subversive poster: at present, the thing has but one effect—to convert every motorist in the Bombay Presidency to rank socialism.

At mile sixty-three, while we were doing an uneasy 16 knots over a surface resembling a frozen storm at sea, Georgina declared that an adventitious sound had developed in the region of the engine-room. Café was of the same opinion. I was on the bridge and, with all my powers of concentration centred on steering an uncharted and hazardous course, I was unable to detect any fresh element in the general racket. Noii concurred.

The question was settled at mile sixty-four, when a rending, crashing

noise in the bilges for'ard dominated the prevailing din. The car lost steerage way, wallowed in the trough of the macadamized waves, and broached to with a jerk which brought the edge of Georgina's hat-box into violent contact with Café's left ear.

A rapid survey revealed that the battery lashings had carried away, so that the battery itself was practically adrift. A painter, in the shape of one of the main leads, had served to tow it for some distance along the road; but a battery is not to be recommended as a motor sea anchor: although efficient, it is uneconomical.

The castaway was raised into position by building under it a pyramid of rocks collected from the surface of the road.

Two goatherds, three passers-by and five agriculturists arrived to view the proceedings.

I began to fasten the battery in place by means of a jury rig composed of tyre levers and wire.

A 'bus hove into sight, drew alongside, and disembarked an enthusiastic driver, his perspiring mate and some twenty interested and chatty passengers.

We were gently but firmly elbowed to the outskirts of the crowd, my jury rig was dismantled and a contraption resembling an ancient set of tonga harness took its place.

At the expiry of thirty minutes I was invited to take my seat in the car for the purpose of starting up.

The crowd held its breath: the engine was cranked: the self-starter buzzed—and nothing happened. The sparks refused to fly.

A second 'bus appeared in the offing. Presently it ranged alongside and discharged an energetic driver, his grimy mate and about twenty excited and voluble passengers.

I suggested that the battery had been affixed wrong end foremost. This was confirmed by driver No. 2 and cheerfully acquiesced in by driver No. 1.

While the battery was being reversed I was tactfully pushed to the outskirts of the crowd. It was more salubrious there, anyhow.

Another period of thirty minutes elapsed, when I was graciously permitted to take charge of the controls.

For the second time the sparks refused to fly. Consternation.

Twenty minutes passed in a process of elimination. Sparking plugs, Delco point, self-starter, dynamo—everything was discussed, poked, filed and blown upon to no effect.

Still the sparks refused to fly.

Eventually an elderly baniya gave it as his deliberate opinion that the inside of the battery was damaged beyond repair. From the outset I had harboured a hidden fear that such might be the case; but to hear it

proclaimed loudly and brutally in broad daylight before a gaping multitude was too much for me. Shouting "Never, never!" I flung myself in the direction of the baniya. The crowd scattered, the baniya displayed an agility very commendable in one of his years and I—well—I stopped short, not knowing what next to do.

In order to dissemble my confusion and gain time, I thrust my head under the dashboard—the place which houses an inextricable tangle of wires, cables, levers and tubes.

Apparently driver No. 2 considered this to be a brilliant action on my part, for suddenly I found—by physical contact—that his head was also under the dashboard. While he was fiddling about with the wires, cables, levers and tubes, the engine started with a roar which made the mob jump.

I asked the wizard how he had done it.

His answer was an enigmatic smile.

It was a good answer.

While distributing largesse, I made many apologies to all and sundry, thus: "It is most noble of you all to have waited here for 1½ hours in order to help us, total strangers." Everybody rejoiced over the happy issue, but nobody understood the purport of my apologies. That is India, unsophisticated.

We got under way at once and, helped by a hearty send-off, dropped anchor in the 'bus stand, Satara, shortly after.

The number of 'buses, charabancs, lorries and other motor vehicles in this place was astonishing. The air was heavily charged with the gases of combustion and laden with dense clouds of dust. The noises of horns, klaxons and crashing gears, and the babel of a swarming humanity blended in a deafening din. The sun beat fiercely down on this petrolized inferno. A dusky Vulcan undertook to make a satisfactory and permanent job of the battery. We retired to the interior of a derelict 'bus, there to consume our tiffin in purdah.

Vulcan was as good as his word: within 40 minutes we were off again, but with only seventy miles behind us, and still a hundred and forty-two to be covered before nightfall.

(*To be continued.*)

Editorial.

HÆMOLYTIC STREPTOCOCCI.

One of the most important duties of the bacteriologist of late years has been to classify the streptococci for the guidance of the clinician.

Sir Frederick Andrewes devoted the last working years of his life to the solution of this problem. He hoped that by making use of modern refined methods of analysis he would be able to secure the identification of given streptococci with particular varieties of disease; but though he devoted seven years of arduous labour to the subject he was unable to attain his object. The results of his investigations have just been published by the Medical Research Council. The work, carried out with meticulous attention to detail, has cleared up many confusions and revealed so many pitfalls in serological studies that we think a short description of the more important studies may be useful to our readers.

Andrewes wrote that "the hæmolytic streptococci stand in the forefront of bacteria harmful to mankind." They are of especial danger to the patient because they can invade the lymph-stream and spread widely from the primary focus of infection; they can also invade the blood-stream and cause metastatic infections in different organs. They are found on the mucous surfaces of the healthy body, especially in the nasopharynx, and acting as secondary invaders often cause a fatal result in such diseases as measles and influenza.

The streptococcus was first recognized by Ogston in 1881, and Rosenbach in 1884 gave thename *Streptococcus pyogenes* to the short-chain coccus he found in suppurative conditions. In 1903, Schottmüller established the hæmolytic properties of this coccus on blood-agar plates, and many authorities have employed the term *Streptococcus hæmolyticus* in a specific sense. Andrewes objects to the use of this name as there are other streptococci which hæmolyze blood corpuscles and the hæmolysis varies in degree. The *Str. pyogenes* has definite biological characters which enable it to be recognized.

In some septic sore throats, traced to the consumption of milk from infected cows, a streptococcus has been found differing from the *Str. pyogenes* in the possession of a capsule and growing as large moist colonies on agar plates. Davis gave it the name *Streptococcus epidemicus*. Andrewes thought it was rash to separate off a species merely by the presence of a capsule. With this exception he considered *Str. pyogenes* a good species in a natural history sense and as it is a typical hæmolytical streptococcus he proceeded to study its hæmolytic powers.

Two degrees of hæmolysis are now recognized: α-hæmolysis, where there is a narrow zone round the colonies, and β-hæmolysis, where there is

extensive clearing around the colonies. *Str. pyogenes* produces β-hæmolysis by means of a definite toxin which destroys the limiting membrane of the erythrocytes. The production of this hæmotoxin is now considered as the true test of a hæmolytic streptococcus.

In order to test for hæmolysis, the streptococcus is grown in peptone broth containing ten per cent of serum for twenty-four to forty-eight hours. When good growth has occurred the tubes are centrifugalized and one drop of a dense suspension of well-washed horse erythrocytes is added to each ten c.c. tube. The tubes are incubated at 37° C. and examined after 20 minutes, 30 minutes, 60 minutes, and then hourly.

Three changes may be observed: hæmolysis, reduction, and the formation of methæmoglobin. With an active strain, hæmolysis is generally complete in twenty minutes, but it may take two or three days. A second trial may give complete hæmolysis, when on the first trial the reaction had been unconvincing. Reduction only takes place in the presence of living cocci and may occur before hæmolysis. It is part of the respiratory function of the active coccus and is not due to any product secreted into the culture medium.

The hæmolytic streptococci are not so active as many non-hæmolytic ones in their ability to form methæmoglobin, and with them it is rarely seen within an hour, though often well marked after four or five hours' incubation. Some of the methæmoglobin formed may be due to acid formation by the cocci.

The hæmolysin of *Str. pyogenes* can be filtered off by means of a porcelain filter, but the time taken to pass depends on the permeability of the filter.

Having studied hæmolysis in some detail, Andrewes then took up serological studies with his strains, all of which he considered might strictly be classed within the limits of the species *Str. pyogenes*. He had 200 strains in all. Among these, 64 were from scarlet-fever cases, 62 from surgical infections, 63 from puerperal sepsis, and 11 from erysipelas. Each of these was tested for agglutination with sera in his possession, and as regards sugar reactions and hæmolytic power.

The first difficulty encountered was the preparation of a stable suspension of streptococci. Following Topley's advice, the suspensions were made from growths on solid media, first dried for an hour or two in the 37° C. incubator. Suspension stability is now considered to be a matter of electrical charge. One may picture bacteria as carrying free electrons on their surfaces, constituting a negative charge, and it is the robbery of these electrons by the kations of the electrolyte which abolishes the charge and allows the attractive forces to gain the upper hand. A stable emulsion is then one in which the negative charges are active and well developed.

Before proceeding to serum agglutination Andrewes made experiments on acid agglutination, as there seems to be a parallelism between acid agglutination and serum agglutination. Sorensen's mixture of sodium

acetate and acetic acid was used; it is so well buffered that the addition of a streptococcus suspension in water or saline scarcely affects the pH. The range varied from pH 3·2 to 6·8. It was found that marked agglutination ceased sharply after a pH of 4·4 or sometimes at 4·7. The limit of acid agglutination was very uniform; only three strains were found with no agglutination at all. Two of the strains had a bovine source and failed to give a strict hæmolysis and also fermented raffinose. The third strain had a human source, and in other respects was quite indistinguishable from *Str. pyogenes*. With this exception acid agglutination was found to give no real help in grouping the hæmolytic streptococci.

In serological studies Andrewes considered it was necessary to have a saline emulsion of streptococci which would remain stable for one and a half to two hours in the water-bath at 55° to 56° C., combined with readiness of specific agglutination with the appropriate serum. He found a growth in glucose broth which was stable, but the response of a growth on glucose agar to specific serum was often so low as to be largely useless. A legumin-agar plate made from the glucose broth culture was, however, found to yield a growth which was stable and agglutinated normally with the homologous serum. So the standard method was to employ glucose broth as the penultimate culture, and then plate from this on to legumin-agar. A convenient density of this emulsion was 300 million per cubic centimetre, and the acidity between pH 6 and 7. The perfect control tube must show no trace of granularity when examined under a hand lens. Normal serum should not be added to the control tube, as it exercises a shielding effect on the action of the electrolyte upon the particles suspended in the fluid and thus might conceal spontaneous agglutination. It is quite a common thing for a series of tubes put up to show an ordinary serum agglutination to appear negative in those containing the strongest dilution of serum, and then to show progressively increasing agglutination as the higher dilutions were reached. A control tube containing only electrolyte shows this up for what it really is—spontaneous agglutination.

In the preparation of the agglutinating serum Andrewes used intravenous injection of an emulsion containing about 3,000 million *dead* cocci per c.c., the dose rising in a series of twelve injections from 0·1 c.c. at the beginning of the course to 2 c.c. at the end. When proper precautions were taken he did not find the response was generally "group" in character. This might be the case when an animal was immunized with a crude strain of streptococcus without regard to the properties of the individual colony from which the immunizing emulsion was bred. By carefully testing the properties of an individual colony and making a formolized emulsion from it he found that a rabbit immunized throughout with the same emulsion "yielded a serum which reflected with fair accuracy the properties of the coccus used."

In agglutinin absorption work with the hæmolytic streptococci the absorbing dose was determined by absorption of a serum with its homo-

logous coccus in graduated doses. This was found to have manifest advantages over a single dose, and was adopted in all cases.

Andrewes also tested the antigenic constitution of a strain in another way, namely, by the range of absorbing powers which it exhibited amongst a number of other sera. Some of the sera were highly specific, others "group" in character. He found that a group serum was exhausted by other group strains and by any specific strain which possessed as an antigenic component a sufficient amount of a group antigen (which most of them possessed, even so specific a strain as Type II). But a specific serum was unaffected in titre by any purely group strain and by any other specific strain. He pointed out, however, that the conclusions to be drawn from the behaviour of an absorbing strain and absorbed serum are different. A serum is not liable to vary qualitatively, but only to deteriorate quantitatively. But a living coccus is subject to internal mutation in successive subcultures, and therefore we can have no real guarantee that a present subculture is identical in its properties with a stock culture from which it is descended.

In 1922 Miss Cowan, working chiefly with hæmolytic streptococci, isolated what she called "rough" and "smooth" colonies; both were equally hæmolytic, but the smooth colonies were much more virulent than the rough colonies. In 1925 Armstrong isolated a highly virulent streptococcus which also formed rough and smooth colonies, but the rough were more virulent than the smooth. Griffith, Todd and Eagles also described colonies of different kinds formed by hæmolytic streptococci. Eagles found no difference as regards hæmolysis and toxin production between the rough and the smooth colonies, but there was no necessary correlation between virulence and colonial form.

Andrewes studied the serological differences between these different forms of colonies which appeared to have a real existence. He found that in no case was the smooth form agglutinated by the rough serum; while in the case of two strains the rough form was not agglutinated at all by the smooth serum; in another strain the rough form was agglutinated equally by its rough and smooth sera. All the smooth forms of the races studied seemed to have much in common and were agglutinated by any one of the smooth sera. This was not so with the rough forms, which showed a considerable degree of specificity. But further studies by the absorption method showed that a rough form might show group properties and a smooth form might even show greater specificity than a rough form. The smooth forms gave uniform turbidity in liquid media and emulsified well in saline; the rough forms showed the reverse properties.

Andrewes found the rough forms were more virulent. These were the forms which appeared in strains freshly isolated from morbid conditions of the body, but the saline instability rendered it difficult to prepare from freshly isolated strains suitable emulsions for agglutination—a grievous drawback to prompt serological classification.

When making his absorption experiments, Andrewes naturally expected to find the titre of the serum untouched, or reduced, or totally extinguished. In some of his experiments, however, the result of saturation was to *raise* the initial titre of the serum. This was very frequent with hæmolytic streptococci, and occurred in no less than thirty absorption tests after saturation with heterologous streptococci.

Zones of inhibition in precipitin and agglutination are well known, and, since the work of Neisser and Friedmann, have been explained as due to disturbance of the quantitative relations of the colloidal substances concerned. The zones can be removed sometimes by washing with acetone; and also by treatment of the serum with kaolin, after a dose of 0·9 g. per cubic centimetre, an inactive serum would give good results. But quite apart from doctoring with kaolin or doping with acetone, Andrewes found that the titre of a serum for its own coccus could be raised by heavy saturation with a totally heterologous organism. There seemed to be an *unspecific removal* from the serum of some unknown inhibiting substance. This factor is erratic in its incidence and cannot be foretold. It seems that in an absorption test the very delicate colloidal balance is readily upset by the slightest change in any one of the ingredients.

In 1907 Kruse pointed out that one cannot deduce the identity of two allied organisms unless each is found to absorb the serum of the other. This principle of reciprocal or "mirror" absorptions is well illustrated in the hæmolytic streptococci. Andrewes found that only exceptionally are two strains of streptococci serologically identical, and very rarely are they entirely dissimilar. Almost always there is more or less group antigen in common between them; there are even definite hints that more than one group antigen exists.

From his study of the racial inter-relationships of the hæmolytic streptococci Andrewes confirmed the individuality of Griffith's scarlet fever Types I, II and III, but Type IV seemed to be mainly a group form. He thought that no one serological form of streptococcus could be credited with the causation of scarlet fever. No distinct types stood out from the miscellaneous assortment of puerperal, surgical, and erysipelas strains of streptococci which he studied, though occasionally representatives of Griffith's scarlet fever Types I and II were found amongst them.

At the end of the summary of his report Andrewes wrote: "A serological study by methods more accurate and quantitative than most workers have used has failed to bring order into chaos. The more one studies hæmolytic streptococci the more strongly is the impression gained that they are in a constant state of flux in which it is difficult to find any firm foundation for a permanent systematic classification."

Clinical and other Notes.

A CASE OF TYPHUS DUE TO TICK BITE.

By Captain C. R. CHRISTIAN,
Royal Army Medical Corps.

The following notes of a somewhat rare condition may be of interest. A patient, Mrs. W., was admitted to the British Military Hospital, Delhi Cantonments, on February 28, 1932, suffering from fever accompanied by a rash. She had carefully noted her temperature since February 23 and gave the following history.

On about February 18 she discovered a reddish-brown tick about a quarter inch long (including legs) attached to the skin immediately over the left inguinal glands. It was removed with some difficulty, but the spot did not bleed or itch afterwards and she therefore did not scratch or irritate the lesion. There was apparently no ill-effect at first, but two days later the lymphatic glands immediately underneath commenced to swell and became somewhat painful. Iodine was then applied.

About three days after the commencement of the glandular swelling she felt feverish and took her temperature (100·6° F.). The onset of the fever was fairly quick but not abrupt, unaccompanied by shivering, and causing only a slight discomfort. During the first four days of the fever she led a fairly active life, taking to bed only on the evening of February 26, when her temperature reached 104° F. The course of the disease is shown below.

February 23, 24, 25.—Commencement of fever. Tenderness left inguinal glands continued. Ate normal diet and pursued normal duties. No definite symptoms. Developed slight tenderness of glands in right groin and left axilla. Patient also felt some pain in the back of the neck on each side, probably due to glands in the posterior triangles as she thought she could feel these glands. Carried on ordinary work. Slight feeling of heat and weakness only; no headache or pain in any other part of the body.

February 26.—Visited dog show. Developed rash which did not appear to start in any particular part but quickly came out on body, face and limbs. Some cramps in calf muscles. Took to bed.

February 27.—Bad cramps in calf muscles. Pains in muscles and joints of limbs, especially wrist and finger-joints, making it difficult to grasp objects.

February 28.—Admitted to British Military Hospital, Delhi Cantonments. Symptoms as above. Slight soreness of throat; pharynx somewhat injected.

Rash.—A generalized eruption including the face and scalp of large pink spots, maculopapular, often petechial, about one-tenth to one quarter inch in diameter and discrete. Better marked on the limbs and most marked on the buttocks. Least on the palms and soles. There were no lesions of the mucous membrane of the mouth or throat. No itching or other symptoms. Original lesion over left inguinal glands still visible as an angry red spot about one quarter inch in diameter; this spot was present for some days before the general eruption and was apparently at first vesicular.

Physical Examination.—Eyes very injected and pupils contracted. Tongue showed thick whitish fur. Spleen just palpable and firm (several attacks of malaria as a child; last attack 1926). Liver normal. Examination otherwise negative. Blood-films negative as regards malaria and spironema. No enlarged glands can be felt in the axilla or neck, but these areas are tender on palpation. Left inguinal glands still slightly swollen and tender.

Treatment.—Aperients, sodium salicylate, "three-fifteens."

February 29.—Further blood-films negative. Hyperæsthesia and hyperalgesia making it difficult and painful to obtain specimens of blood or to use a tourniquet.

March 1.—Blood taken for Weil-Felix reaction, for culture, and injected intraperitoneally into a guinea-pig. Aspirin and Dover's powder were given at night.

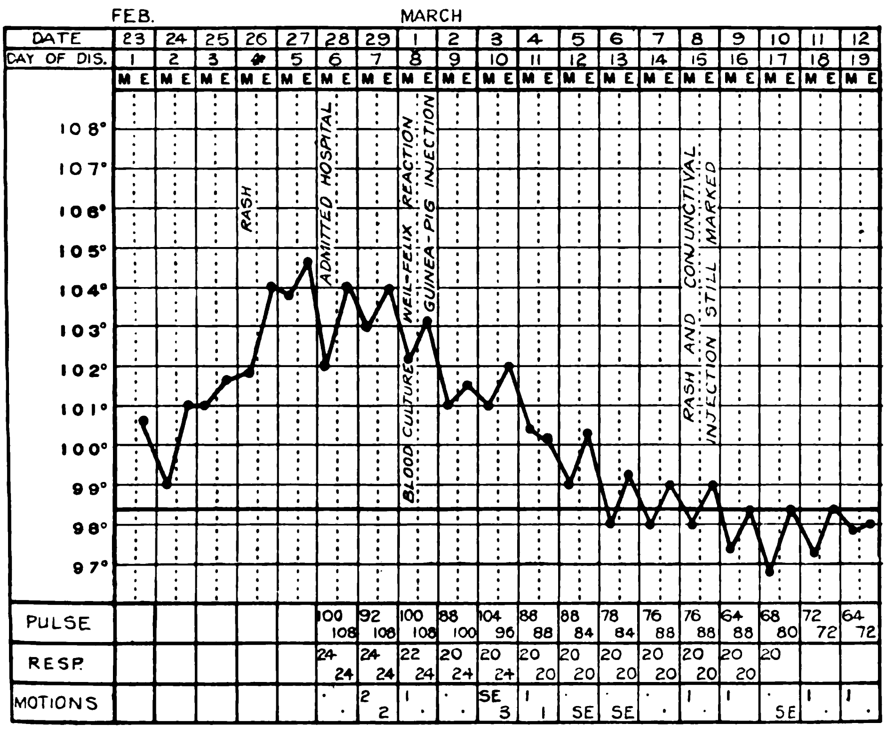
March 2 to 8.—Gradual subsidence of fever and lessening of symptoms. The rash and injection of conjunctivæ showed no change until March 9 when marked improvement set in, though the eyes took several days and the skin about three weeks to become quite normal. Very slight desquamation occurred, limited to skin lesions. Fur on the tongue became moist brown during the last few days of fever. Convalescence was uninterrupted but was accompanied by marked weakness, especially in the leg muscles, necessitating massage. Sinus arrythmia for some days followed; but the patient is subject to this condition after fever, etc. Sleep was somewhat disturbed during the attack but there was no marked insomnia.

Source of Infection.—Mrs. W. had been living at Meerut for some months before infection, though she occasionally came into Delhi. She does not remember handling rugs, carpets, etc., or any bazaar produce likely to have been conveyed by camel or pack-animal. She keeps four wire-haired fox terriers but has never discovered ticks on them, and they have always been healthy.

Discussion.—The disease in India is more common in the hilly districts in summer and autumn, but also occurs in the plains during winter. Closely resembling Rocky Mountain spotted fever, though milder in type, it is supposed to be spread from rodents to man by the *Rhipicephalus sanguineus*. The actual rodents, however, have not been identified. The disease is apparently not spread from one patient to another (cf. louse typhus). The

case described is fairly typical of a mild attack, but the incubation period was only five days (usually seven to twelve days), and in most cases the onset is sudden, accompanied by shivering, headache and backache. The appearance of the rash in the period third to fifth day of fever was typical; also its maculopapular nature becoming darker and petechial after a few days, persisting throughout the disease and taking several weeks to fade.

The above case was remarkable in having no headache, backache or any signs or symptoms of bronchial irritation throughout the attack. The more severe symptoms, jaundice and delirium, were absent while insomnia was mild. Constipation was definite and required repeated enemata. Most



marked were the pronounced hyperæsthesia of the limbs and the pains in the muscles and smaller joints, with considerable restlessness. The total white and differential counts were normal, though in most cases a leucocytosis occurs with increase of large mononuclears. In Indian tick typhus the Weil-Felix reaction and animal inoculations are usually negative. A reaction with a dilution of 1 in 80, however, is probably positive (much higher titres are often found in louse typhus). The lymphadenitis and local lesion present in the case cited are unusual features.

I am indebted to Lieut.-Colonel C. R. Millar, D.S.O., R.A.M.C., Officer Commanding British Military Hospital, Delhi Cantonments, for kind

permission to forward this case for publication, and to Major J. Bennett, R.A.M.C., Medical Specialist, Meerut District, for his advice and assistance.

NOTES ON THE LABORATORY INVESTIGATION OF THE CASE.

By Major R. A. HEPPLE, M.C.,
Royal Army Medical Corps.

This case presents features of considerable importance, as there is a definite history of a bite from a tick about five days prior to the onset of illness.

The laboratory investigations carried out may be of interest and were as follows:—

Blood culture, March 1, 1932, sterile.

Agglutination of the Patient's Serum.

For this purpose fresh strains of *B. proteus*, Kingsbury, Warsaw and Multesar were obtained from Kasauli, as well as "O" emulsions of the same organisms. The Multesar strain was not used in the investigation, as sufficient serum was not available for the purpose. The results were as follows:—

Strain		*Agglutination*
Kingsbury	"H"	1/25
,,	"O"	Trace 1/125
Warsaw	"H"	Trace 1/25
,,	"O"	*Nil*

The patient's serum was again received on March 16, and the agglutination results were as follows:—

Strain		*Agglutination*
Kingsbury	"H"	1/50
,,	"O"	Trace 1/50
Warsaw	"H"	1/25
,,	"O"	Trace 1/25

On March 1 a few cubic centimetres of the patient's blood were injected intraperitoneally into a guinea-pig by Major Bennett, and the animal was brought back to the District Laboratory for further investigation. No signs of disease followed the injection and the rectal temperature never rose above 102° F., which according to controls appears to be the normal temperature of guinea-pigs.

On the eleventh day after the injection four cubic centimetres of blood were withdrawn from the guinea-pig's heart. Two cubic centimetres of this were injected intraperitoneally into guinea-pig No. 2, and the serum of the remainder was used for agglutination tests. The results were as follows:—

Strain		*Agglutination*
Kingsbury	"H"	1/50
,,	"O"	1/50
Warsaw	"H"	*Nil*
,,	"O"	Faint trace in 1/25

As a control the agglutination titre of the serum of healthy guinea-pigs was tested against the same strains with the following results:—

Strain		*Agglutination*
Kingsbury	"H"	1/25
,,	"O"	1/50
Warsaw	"H"	*Nil*
,,	"O"	*Nil*

Nineteen days after the injection of guinea-pig No. 1 with the patient's blood this animal was killed. Immediately prior to its death several cubic centimetres of blood were withdrawn from the heart. Of this blood three cubic centimetres were injected intraperitoneally into guinea-pig No. 3 and the remainder provided serum for further agglutination tests.

An emulsion of the brain of No. 1 was made in saline with precautions to ensure sterility, and three cubic centimetres were injected intraperitoneally into guinea-pig No. 4. Sections of the brain, spleen and testicle of guinea-pig No. 1 were made and examined. No rickettsia bodies were seen.

The serum of guinea-pig No. 1 was again tested for agglutinating properties with the following results:—

Strain		*Agglutination*
Kingsbury	"H"	Trace in 1/50
,,	"O"	,, 1/125
Warsaw	"H"	*Nil*
,,	"O"	*Nil*

A control test was again conducted with the serum of a normal guinea-pig with the following results:—

Strain		*Agglutination*
Kingsbury	"H"	Trace in 1/25
,,	"O"	,, ,,
Warsaw	"H" and "O"	*Nil*

The history of the three surviving guinea-pigs is as follows:—

No. 2 (injected with blood of guinea-pig No. 1 on March 12, 1932.)

This pig's temperature remained normal for seven days, at the end of which time it rose to 103° F. At this level it remained for a further seventeen days. It then rose rapidly to 105° F. and remained at this height with slight intermissions for a further seven days. It then gradually sank to normal.

The blood of this animal was taken for agglutination on the twenty-fifth day after its injection. The results were as follows:—

Strain		*Agglutination*
Kingsbury	"H"	Trace in 1/50
,,	"O"	1/25
Warsaw	"H" and "O"	*Nil*

Unfortunately, owing to the move of the laboratory to the hills and the pressure of other more urgent work, no further agglutination tests could be carried out.

No. 3 guinea-pig (injected with the blood of No. 1).

Three days after injection this animal's temperature rose to approximately 104° F., remained at this level for four days and then sank to normal. It remained at the normal level for four days and then between 102° F.

and 103° F. for a further fourteen days, when it became normal or slightly subnormal.

Blood for agglutination tests was taken from this animal twenty days after it was injected. The results were as follows:—

Strain		*Agglutination*
Kingsbury "H" ..	..	1/50
,, "O" ..	..	1/25
Warsaw "H" and "O"	..	*Nil*

No. 4 guinea-pig (injected with emulsion of brain of No. 1).

This animal behaved in exactly similar fashion to No. 3, except that the temperature throughout was a shade higher.

Blood for agglutination tests was taken from this animal on the twentieth day after injection. The results were as follows:—

Strain		*Agglutination*
Kingsbury "H" ..	..	1/50
,, "O" ..	..	1/50
Warsaw "H" and "O"	..	*Nil*

The results of this investigation are necessarily incomplete and inconclusive. It is worthy of note, however, that in almost every case the agglutinating titre of the serum of the animal on which infection was being attempted was higher than that of the healthy control animal. The rise of temperature and its maintenance in guinea-pigs Nos. 2, 3 and 4, is also considered to be worthy of note, and suggests that infection[1] may have been present in guinea-pig No. 1.

It is regrettable that sufficient of the patient's serum was not available for test against the Multesar strain of *B. proteus* × 19. In another more recent case of tick typhus (upon which it is hoped to publish a note) rising agglutinins for this strain reaching a titre of 1 in 1,000 were found with the "O" emulsion.

TWO SIMPLE ANTI-MOSQUITO MEASURES.

By Captain T. F. M. WOODS,
Royal Army Medical Corps.

First Measure.—During a recent perusal of a fairly wide range of anti-malaria literature it was noticed that, among a host of others, a simple but efficient means of preventing mosquito breeding was not mentioned by any author. As the method might be of interest to Cantonment anti-malaria workers in India, it was considered to be worthy of description. The method deals with the elimination of breeding in large and deep borrow pits which are so commonly made in order to obtain large quantities of earth with which to make rifle ranges, etc. These huge pits, which may be as

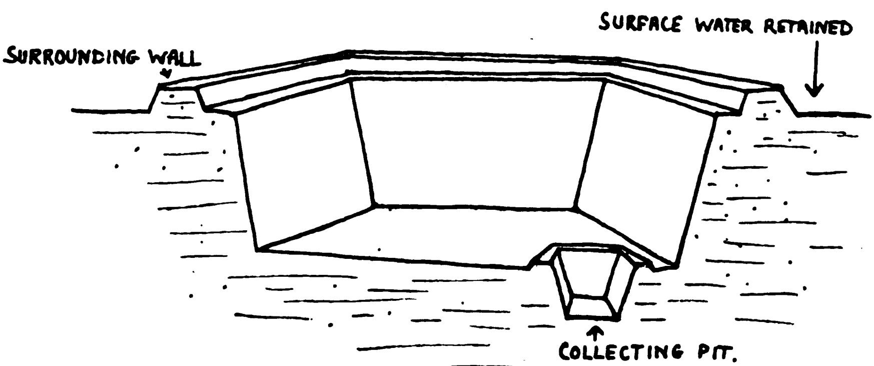
[1] Memorandum on Medical Diseases in Tropical and Subtropical Areas, 1930, p. 278.

much as 70 yards long by 30 yards wide by 15 yards deep, become filled with water from the surrounding ground during the monsoon. The water thus collected remains as a very potent source of mosquito breeding for several months.

A wall or bund two feet high by three feet wide is constructed completely surrounding these pits. This wall effectively prevents surface water from the surrounding ground accumulating in the pit. A shallow depth of water which is retained on the surface of the ground over a large area disappears in a few days owing to evaporation and percolation.

Some water collects in the pits, and is dealt with by levelling the floor of the pit with a slight fall towards one end, at which a small pit about 4 yards by 4 yards by 4 yards is made. This small pit in its turn has a small wall a few inches high constructed round it, and some degree

DIAGRAMMATIC SECTION OF BORROW PIT



of evaporation and percolation from the floor of the large pit takes place. In the small pit any water which eventually collects has a small surface area which can easily be treated every week with oil or Paris green.

The main feature of this simple anti-mosquito measure is the first wall round the entire pit, which is easily and comparatively cheaply constructed. The levelling of the floor of the pit and the construction of a small collection pit, while not so essential, are somewhat more expensive measures.

This method of preventing the accumulation of water in large borrow pits which are too deep to drain and too big to fill in has been used with great success at Sialkot in the Punjab for the last few years.

Second Measure.—A simple method of oiling slowly running water which has also been used at Sialkot is a modification of that described

by Wetmore [1]. Wetmore's method consists of putting oil into specially constructed conical cans which are then submerged in water; the surface of the water becomes treated by means of oil escaping through wicks in the cans.

At Sialkot ordinary Quaker oats tins, which have air-tight lids, were obtained free from the canteens. These tins were filled with oil and a few stones to make them sink. When required for use they were punctured at the top and bottom by means of a hammer and a nail and thrown into the upstream end of slowly flowing water. Oil which escapes from the tins and slowly spreads an even film over the surface of the water is replaced by water. It is claimed for this method of oiling that it is clean and economical. Specially constructed cans are not necessary. The expense of constructing and the attention required in maintaining drip cans, oily gunny bags, etc., is eliminated.

A further advantage is that, as the oiling apparatus is submerged it is not seen, and is free from the attentions of curious natives.

REFERENCE.

[1] Wetmore, W. O. (1926) *Journ. Amer. Med. Assoc.*, vol. lxxxvii, p. 1928.

Travel.

PEREGRINATIONS AND PASSPORTS.

By Colonel C. D. MYLES, O.B.E.

On being granted six months' home leave from Hong Kong in the spring of 1931, the choice of itinerary was raised.

P. and O.—Hong Kong to Tilbury—was easily the most comfortable. Nothing to do but get on at Kowloon Wharf and step out at Liverpool Street. No passport, nothing much in the customs line, and first-class Englishmen to deal with all the way. On the other hand the Canadian Pacific route offered a little variety and very much the same conditions of travel. Lastly, there was the Siberian route. Inquiries disclosed that there were many formalities, and even then the choice of route from Hong Kong to Mukden had to be decided, i.e. (1) Hong Kong to Dairen direct by boat, and then train to Mukden; (2) Hong Kong to Shanghai by boat, change into another ship and proceed to Dairen, and again train to Mukden; (3) Hong Kong by boat to Shanghai, and continue by boat to Tientsin, and then to Mukden. In addition there were passports and visas, tickets, reservations, permit from British Legation, Peking, food and limited kit for journey, and heavy baggage by long sea route. The one salient gain was time. Twelve days and then London.

Consideration brought out that I was very tired of the Indian Ocean route. The C.P. route meant two long sea trips with a long railway journey

in between, and it seemed expensive. In this way it became obvious that one was automatically selecting the Siberian route, and so it was, as I was due to pay a visit of inspection at Peking, I decided on the route Hong Kong—Shanghai—Tientsin—Peking, and then to book straight from Peking to London.

Passports were at once obtained and visas searched for. I was informed that the Russian visa could only be obtained in Mukden and the Chinese and Polish visas in Shanghai. On approaching the Japanese Consulate for a visa, they said the route I was proceeding by did not cross Japanese territory and so I was put off. Alas, the failure to obtain it was to give me much food for reflection later on and to lead me into difficulties.

Permission to travel via Siberia was obtained, and voluminous orders on the subject were digested. A large book of tickets was obtained from Thomas Cook and Son, and heavy baggage was sent off by long sea route. Everything seemed to be in apple-pie order. I was due to sail for Shanghai on March 29, when orders came to the effect that a trial by ordeal, known as (h) (v) Examination for Promotion of Majors, R.A.M.C., to Lieutenant-Colonels, R.A.M.C., which was due to take place in Hong Kong in October, 1931, should now be held in Shanghai on the same date. This meant I had to be in Shanghai at least one week earlier, and must take a boat sailing on March 18 from Hong Kong. The earlier departure entailed hurrying up matters, but it also meant that I had to begin my journey in mess kit, for in the absence of the President of St. Patrick's Society, Sir Joseph Kemp, K.C.B., Chief Justice of Hong Kong, I was acting for him at the Annual Celebration of the Hong Kong Irishmen, and my boat left very early in the morning on the 18th. It had one great advantage in that my ship changed from a small one-lunger to the palatial "Empress of Russia." All Irishmen will be glad to hear we had a real fair night in spite of a perfect deluge on March 17, 1931. I did not miss that boat, and some of the enthusiasts came to see me off, and arrayed my cabin accommodation like Kew Gardens in spring, after the manner of Hong Kong send-offs. *En route* to Shanghai the Commander showed me over the bridge, explained various mysterious apparatus, and we had tea with the Captain in his den "up top-side." I felt regrets that I had not chosen the C.P. route, but the die was cast.

On arrival at Shanghai we set about visas. Our first essay was the Polish one. It entailed a drive to the utmost confines of the French Concession, to be met with the news that we must leave our passports and come back in four hours' time. The Consul was a very mysterious man. However, we got that visa eventually. Then for the Chinese—drive to the Secretariat in a taxi—shove and push one's way through the usual Chinese crowd. Here was prompt attention and efficiency; they let us have our visas in a short time.

We had a few enjoyable days in Shanghai (the Paris of the East), finished my business, and embarked in the s.s. "Fengtien" for Tientsin,

calling at Wei-hai-wei and Chefoo *en route*. The "Fengtien" was a cockle compared with the "Empress," but we arrived at Taku Forts in fair time, and went up the narrow, tortuous Pei-ho River for a distance of forty miles to Tientsin. The Gulf of Pichili is very shallow and usually puts up an aggravating type of steep wave; the water is almost always a sepia colour from the silt of the Yellow River.

Taku Forts are approached through a sixteen mile channel, through mud banks called the bar. The Pei-ho River is rapid, shallow, narrow and tortuous, and of a deep chocolate colour. The narrow central channel is kept open by dredging and by taking advantage of floods to wash away the sedimented silt. The channel is so narrow that boats meeting keep a head-on course until the last moment, when they veer out a couple of degrees and just miss each other. The first time I experienced it I nearly got heart-failure at the close shave, but the captain said that was the only way, for if they steered wide too early the edge of the channel would be hit and they would come into collision. He said grazes were ordinary experiences, but I never saw two boats actually touch. As boats pass along a very steep wash is produced, causing small river craft to gyrate in all directions. There is a peculiar craft on the river called the Snake-boat, which consists of two or three barges, clamped together by grapplings. It has a very tall mast and huge sails. The joints are for the purpose of aiding the passage of corners on the sharp bends. Believe it or not.

Tientsin is the ancient inland port of Peking, whence Marco Polo set out on his final return journey to Europe. It is situated on the banks of the Pei-ho, and used to be very subject to floods, but this difficulty was quickly got over by simply pumping the river water into bunds, and catching the silt. It has a Chinese city, and English, French and Japanese Concessions or Settlements. There was a German Settlement which was taken over by the Chinese during the Great War. The Country Club is an example of what thought and endeavour can make out of a wilderness.

On completion of my work in Tientsin, we proceeded to Peking. This is not the place to describe Peking. Suffice to say that every time I see it the less I appear to know about it. The Western Hills, the Summer Palace, and Tartar City always attract me. Having established oneself at the Hotel des Wagons-Lits, a sally was made to Cook's offices to ascertain if the tickets, passports, visas, etc., were in good order. Currency problems arose. The rouble, latt, yen and mark were discussed, not to speak of the almighty gold dollar. The good old English pound was never mentioned, but I could have bought a hatful of sovereigns, brought in from time to time by American tourists, if I were so minded.

A suitable stock of each type of coin was procured as far as possible, but there are eleven different currencies to be handled on the journey. Mr. Cook next inquired as to what food we had, and our basket was produced. "Not half enough. Must have food for a full week. No food in Russia."

Again that good intention put us down into the pit, for we increased our supply until capacity limit was reached. Every demand being satisfied, we took a stroll one nice spring-like afternoon preparatory to an early start on the morrow. Dawn came and with it a hurricane from the north, bringing a cloud of extremely fine dust which penetrated and pervaded everywhere. We were frozen, blinded and choked. We staggered to the train at 7.30 a.m.; the dust was there before us. It was interesting, I remember, to read how Marco Polo fared in the Mongolian dust, but personal experience reduced one to tears that simply made muddy tracks down our faces, and there was no use looking for a handkerchief, for it was muddy also.

We passed through Tientsin about lunch time, when a few friends came to wish us luck and add more admonitions about the Russians, and at sun-down passed Shanhaikuan and through the gap made for the railway in the Great Wall of China.

The garrison of Tientsin have their annual musketry camp line close to the sea, and it is of interest to note that the final fort on the Great Wall of China as it reaches the sea is a British possession. One can see the wall running up into the adjoining hills, and a little further one passes the old Russian earth redoubts put up in the heyday of the Czar. We began to feel the cold now and to enjoy the steam-pipes of the heating apparatus. (And so to bed.)

Next morning, 7 a.m., brought us into Mukden, the Capital of the Manchuria War Lord, Chang Hsueh Liang. What struck one most was that everything seemed to be controlled by Japanese. This was our first change, so we proceeded to the Yumata Hotel. An excellent hotel. We breakfasted and went in search of the Russian Consul, hoping to get our visas quickly and then run out to see the famous Mausoleum—alas for our well-laid schemes!

After some wandering about in rickshaws we located the red flag with sickle and hammer. We entered and were met by a Chinese boy, who motioned to us to chairs in the hall. A wait of about ten minutes in dead silence followed. Then a lady clerk appeared with a little splattering of German and English. We want visas? She would see what could be done. Twenty minutes wait during which various people came out of various doors; on exit they took out a key, locked the door behind them, crossed the hall, took out another key and opened another door, disappeared and locked the door behind them. The lady appears again with forms of application for visa; two hundred questions to be answered of the gardener's aunt type. I complied with the lot, but my wife refused to put her occupation down, merely putting in a dash. Long wait. Lady again appears, collects papers, would we come back again in two hours' time? Alas for our chance to see the Mausoleum. Two hours' time we came back, a delay, and when the lady appears she is very sorry but as there is one question not answered the visa cannot be given. Argument

follows. My wife says she is married, "and I suppose implies not like Russian women." The lady walks away and leaves us to it. I suggest "Not applicable," as I am accustomed to reading medical board papers, and it seems to be the answer that suggests itself to question No. 6, page 4, on Military Pension Form M.P.A. 36—that is duly entered up, and the lady is captured next time she pauses to lock a door in transit across the hall. The cold, waiting, door locking and silence have by this time produced nervous tension. After one more hour of waiting the lady returns with the visa duly stamped on our passport, and I can never say that my time reading board papers was wasted. After a hurried dinner we were able to catch our train at 7 p.m. for the north. We were now in the Japanese express Dairen—Chang Chung. A very fine train, up to the latest American ideals in all respects. At 8.30 p.m. we arrived at Chang Chung and changed into the Chinese Eastern Railway for Harbin. The train came in at 12 midnight, and as we were very cold we thoroughly enjoyed the nice warm beds made down in an old Russian type carriage. We were very comfortable until 8 a.m., when we arrived at Harbin, and got out to await further connection at 4.30 p.m. for Manchouli, the Russian frontier.

On stepping out of the train at Harbin the words of the Christmas carol, "Forth they went together," were vividly recalled as a wind of high velocity straight out of cold storage hit one in the middle. By the time we had crossed the road to the Grand Hotel and found a steam-pipe to sit on, we approached the state in which Canterbury lamb arrives in England.

The Harbin winter must be something to experience.

We were struck by the enormous men and women one met in the street, but closer observation showed their remarkable physique to be solely due to layer after layer of leather coats and their enormous legs due to felt or gunny coverings bound on with cord in the manner of gieves worn by the ancient Greeks.

The winter snows were not yet cleared up, and the general aspect of the whole place was dreary and unkempt. The river Sungari, an enormous river tributary of the Amur, was a large sheet of solid ice.

After much searching we found a truly wonderful store after the nature of Harrod's. Here we purchased a few more edible stuffs and round the corner we were able to get some white bread. We drove back to our hotel in one of the old-fashioned Russian droskys. The driver was piled with clothes, long hair grew in masses from every visible portion of his skin and neither he nor his cat-like pony looked as if they had had food for some time.

Passport tickets and reservations having all been checked by Cook's agent we took our place in a very fine coach on the Chinese Eastern Railway. Presently the station platform was cleared and on to it filed several hundred Chinese soldiers headed by a weird band. They lined up in file and we discovered that the General Commanding the Area was about to proceed north on a tour of inspection. The General arrived and

a salute was given by the band. The soldiers were dressed in their blue, wadded cotton, with cotton gloves and Chinese shoes. They looked frozen, but the General and Staff were well covered in fur. On the whole journey that day and up to dusk there were troops drawn up at each station. These troops were covered in sheep's wool. They were Mongolian rather than Chinese in type. A rapid inspection was made at each station and a salute performed either by a band or some bugles.

Our sleeping berths were comfortable and the restaurant car well served. On leaving Harbin the character of the country changed from one of fertility to large rolling hills similar to the Southern Downs; only grass was visible in any direction. A high wind was blowing and the few people we could see were obviously doing their best to get out of its reach as fast as they could. Every one was garbed in fur. Next morning just after dawn we passed a nomad crowd. They were camped near the line. Outside bivouacs camp fires were going, round which men and women were squatting and cooking. Small children, looking as if their skin clothes were sewn on, were playing about. The climatic conditions were arctic. The flocks, consisting of cattle, ponies, camels and donkeys, were scattered in large numbers all over the place. It was a perfect rendering of some of the scenes described in that delightful book "Genghis Khan, Emperor of all men." This of course was his country and he is reputed to be buried somewhere near Lake Baikal under an enormous jade rock.

12.30 brought us to Manchouli. Customs, passports, tickets, money were all gone into. Roubles worth about ten a penny in Harbin were passed on to one in exchange for gold dollars at the rate of roubles 1.95 per one gold dollar. You had to declare how much you had and in what currencies and get a voucher showing how much money you changed into roubles. Packages you did not wish to open you could have sealed. Literature of any description was very carefully scrutinized, cameras seized upon and sealed up. All these formalities were completed in about two hours, then all passengers were assembled and marched through a door guarded by armed Russians into the Russian section of the station. We were taken straight to our Wagon-Lits compartment.

The carriage was in good condition and perfectly clean. Comparable to any I have seen in any country. The sight of it brought me back to the early days of 1914-18 when I was "the owner" of one, but that is another story. You can make them comfortable by the fair use of certain implements. At 3.30 p.m. we lumbered off and as we passed up through the military quarters were surprised to see very fine six-wheeler lorries cavorting around tracks which stood for local roads. The landscape was the same type of grassy hill, with not a soul in view. Towards nightfall we joined the main Trans-Siberian line at Karymskaya and at dusk crossed the Ingoda River (a tributary of the Amur) and came into Chita. Chita (the ancient Capital of West Siberia) is quite a large place, the houses are simple log cabins, placed each in a small enclosure in rows along open

thoroughfares, which cannot be called roads as they are not metalled. I could not see any attempt at street lighting, and the whole appearance was that of a backwood settlement in which nothing modern existed. There was quite a crowd in the station, all wrapped in leather and fur. Top boots of various types on everybody. There was any amount of dirt around but it was all frozen solid. We all got out and walked up and down for a change. The station crowd were curious, but made no attempt to address us, simply gaped. There was no show of fashion, but no one wore torn or ragged clothing. Rough if you like, but serviceable. The general physique was distinctly robust, even allowing for layers of clothing and all had the appearance of indulging in a couple of good meals daily with relish, as a routine. The comment that came into our minds was, whence do all the stories about starving Russia come. There was no evidence of cheer or gaiety, but the presence of the fierce blast might easily account for the absence of mirth. We found out by close investigations that we might have eight minutes here, so we hailed off to the Kapitok. Kapitok is an institution to be found on all Russian stations, big or small. It consists of a log cabin in which is installed a large boiler with several taps leading out of the wall. Any person travelling by rail is entitled to draw as much hot water as he wants without question or hindrance. The supply is always copious and in most cases on the boil. These places are very popular and at all stations you have to await your turn with your can, but you always get your chance, there is no cutting in, everyone's rights being courteously observed at all times. (Kapitok is the oasis of the bleak Siberian plains.)

What may be said about the rough but serviceable outfit of the local inhabitant in no way applies to the Russian official. The soldiers are very well clad. Their tunics, breeches and boots are first class and their greatcoat is a very superior article. Police officials are trim and smart and one officer of the Aviation Section had a complete leather outfit of a very smart cut. All the officials keep to themselves. They seldom seem to speak to local people. They always carry a belt and some kind of firearm. This was always in their possession. As Liam O'Flaherty says in his recent book, there is no aristocracy in Russia, they have completely disappeared, but the Russian official is the most exclusive autocrat on the face of the earth.

We lumbered off again, night fell, and we retired to bed. Dawn brought us into a perfectly wonderful country—mountains, rivers, open valleys wooded like Kashmir. Fir trees of all types in profusion, including those gorgeous trees the golden fir of Eastern Siberia and the cedar. Snow was in evidence, but only on the top of the trees. The course of several rivers was followed during the day. Towns were not to be seen, but there were many hamlets in the open valleys. About 6 p.m. we penetrated the last ridge and there lay Lake Baikal in front of us. The hill on the far side was completely covered with snow and the lake itself one solid mass of ice.

All local traffic in the shape of sleighs took to the Lake. Every half mile or so along the edge there were rustics lying down by holes, ice fishing.

At dusk we pulled into Mysovaya, which was the terminus of the eastern section in the old days, and where the train was shipped on to the icebreaker to carry it across to Baikal-ozero, on the banks of the Lower Angara. All signs of the pier on which the train ran out to the boat are gone, and generally speaking it is a lonely spot. Lake Baikal, enormous as it is, is an expansion of the course of the River Angara. The Upper Angara enters the most northerly point and the Lower Angara emerges from the south western extremity, flowing south until it meets the great Yenisci. The Trans-Siberian Railway follows the geographical loop formed by the lower end of the lake until it comes to the River Angara, which it follows up to Irkutsk. The sides of Lake Baikal at its south end are precipitous hills, almost cliffs, which necessitate very many short tunnels. On leaving the lake the railway follows the Lower Angara.

Lake Baikal is 400 miles long by 35 broad, circumference 1,200 miles, and area 14,000 square miles. It is the largest fresh water lake in the Old World. Precipices rise from its shores up to 1,200 feet. Depth soundings have been taken down to 3,600 feet. It abounds in fish, and seal of the ocean is found in it. It is 1,200 feet above sea level. Many rivers flow into it, but only one flows out—the Angara. So swift is this stream at exit that it never freezes although the ice in the lake may be six feet thick and the temperature of the air 24 degrees below zero.

After Irkutsk, we crossed into the region of the Steppes, gentle sloping hills with patches of trees but mostly grass.

Lying snow was the rule from Baikal, but now falling snow was almost constant. The flakes were crisp and dry, the snow on the ground hard and powdery. At the bottom of the valleys there were signs of a thaw, but on the high ground the cold was intense, and but for the steam heating of the coaches one could scarcely live. As regards trees, the silver birch was the rule, a monotonous tree when seen without leaves day after day. Forests of good fir did a little to relieve the sameness on occasions.

(*To be continued.*)

Current Literature.

CRISTAN, LIEUTENANT-COLONEL M. **Notes on the Purification of Drinking Water by Javellization and its Application to Military Service.** *Archives de Médecine et de Pharmacie Militaires*, 1932, xcvi, 237.

The first attempt at javellization was made at Paris on the initiative of M. Roux. At the present time, however, this process is widely used in France. Theoretically, Javel water consists of a solution of hypochlorite of potassium, and Labarraque water is a solution of hypochlorite of sodium. But it is now the custom in France to designate under the name of Javel water commercial solutions of hypochlorite of soda, which contain in addition sodium chloride and traces of free alkali produced during the process of manufacture. The microbial action of Javel water is due to free chlorine resulting from the dissociation of the alkaline hypochlorites. Colonel Cristan states that the dissociation is most considerable in the first few minutes, is then prolonged for some time, gradually becoming weaker. The dissociation is quicker the greater the dilution of the solution, and is favoured by the presence of an acid such as free carbonic acid.

The action of chlorine has been supposed to be due to the liberation of oxygen, but it is more complex than this. In 1922 Barber suggested that combinations take place in the lipoprotein wall of the microbes which give rise to bodies having a lethal action on the germs. During the war Bunau-Varilla stated that he could obtain perfect sterilization of all waters used for drinking by means of $\frac{1}{10}$ milligramme of chlorine per litre. To explain these results he suggested that during the destruction of the molecule of hypochlorite, rays similar to ultra-violet rays were emitted, which destroyed living matter. In August, 1927, Louis Malet, in a note presented to the Academy of Sciences, confirmed this emission of special rays by hypochlorite of soda when it is brought in contact with albumin, gelatin, or urea. Some of the rays were luminous, others extended to the ultra-violet part of the spectrum, and were made evident by the production of fluorescence in suitable solutions. It seems probable that the action of very dilute solutions of chlorine must depend on a physical or physico-chemical process.

Techoucyres has shown that simple agitation of water, such as is produced by the action of a pump without the presence of any chlorine, will destroy microbes in a water, even producing a reduction of 90 per cent. in a polluted water. Moreover, the water seems to retain its lethal action for some time after the agitation of the particles has ceased. It seems probable that this action is due to traces of copper derived from the walls of the pump as a result of friction, and found to be present in the water in a pseudo-colloidal state to the extent of $\frac{4}{10}$ milligramme per litre. These

facts seem to be allied to those of the microbial action of minute traces of other metals, notably silver, when brought in a state of fine suspension in contact with an impure water.

From the very commencement of the use of javellization in France there was a tendency to reduce the dose of effective chlorine. It was considered that absolute sterilization of a water was not required, only the destruction of *B. coli.* From 1911 to 1914 Rouquette employed reduced doses of 1, 2, and 3 decimilligrammes per litre in the installations at Marseilles, Avignon, Montauban and Toulon. During the war small doses of chlorine were extensively used and especially on the front at Verdun, hence the process was called "javellization imperceptible," or "Verdunisation." The doses of $\frac{1}{10}$ to $\frac{1}{20}$ milligramme were tasteless and were said to be relatively independent of the composition of the water, so that it was not necessary to make frequent tests of the amount of chlorine required. A very energetic agitation of the water was required and the action of chlorine was more physical than chemical. It was also necessary for the success of the process that the water should contain very little organic matter.

River Pollution—Survey of the River Tees. British Association Meeting at York. Section B (Chemistry).

Dr. H. T. Calvert (Director of Water Pollution Research), in his opening remarks, pointed out that entirely satisfactory methods of dealing with many polluting effluents have not been devised. For this reason, the Government in 1927 instituted the Water Pollution Research Board as a section of the Department of Scientific and Industrial Research. One of the first conclusions reached by the Board was that reliable information was urgently required as to the effects on rivers of various polluting discharges. It was known that rivers which have received polluting liquids are capable of self-purification under certain conditions, but there was a lack of exact knowledge regarding those conditions and the quantities of various effluents which could be allowed to enter a river without unduly retarding the processes of self-purification. It was decided, therefore, to carry out a comprehensive, hydrographical, chemical and biological investigation of a river, comparatively pure in some stretches and polluted in others, and the River Tees was finally chosen.

In its upper reaches above Croft, the Tees receives only unimportant sewage effluents from the small towns or villages situated on its banks. At Croft, however, it receives through its tributary, the Skerne, a large quantity of water much polluted with sewage. From this point downwards for about fifteen miles in the Tees, the self-purification of the river from sewage pollution has been quantitatively studied. The tidal reaches are heavily polluted by sewage and industrial effluents of various kinds. Obviously, the conditions of the non-tidal and tidal sections of the river are widely different and each section has required its special group of investigators, consisting of chemists, biologists and a hydrographic surveyor

working in close co-operation. The scientific results achieved have been well worth the work involved and they constitute an important addition to knowledge of the effects of polluting discharges on a river, and the extent to which a river can recover from pollution.

Mr. J. Longwell, in discussing the rate of decomposition of sewage in the non-tidal reach of the River Tees below Croft, said that chemical and bacteriological observations had been made throughout two complete years. By combining the results of examination of samples of the water with measurements of the flow of the river, the weights of various decomposition products of sewage passing different points in unit time had been determined. It had been shown that a greater decomposition of sewage and subsequent purification of the river was obtained in the hot summer months than during the colder winter months. Thus the breakdown of sewage carried into the Tees by the Skerne at Croft can be described as taking place in a band of decomposition which expands and contracts according to temperature, occupying only a few miles during very hot weather, but stretching to at least fifteen miles in cold weather. In addition it had been shown that bacterial activity precedes the decomposition of sewage in the river, thus indicating that the process of purification is biological rather than chemical in character. At no time during the course of the survey had the dissolved oxygen in the water of the Tees in the non-tidal section fallen to such a concentration as would be harmful to fish, but in the Skerne, owing to sewage pollution, the dissolved oxygen had on several occasions been entirely removed.

In discussing the flora and fauna of the non-tidal section of the River Tees, Dr. R. W. Butcher and Mr. F. T. K. Pentelow said that there are communities of plants and animals which are characteristic of foully polluted, mildly polluted and unpolluted waters. These communities naturally merge into each other according to the degree of pollution. It had been shown that the distribution of certain organisms, such as those classed as "sewage fungus," is closely related to the concentrations of organic matter and ammonium salts as found by chemical analysis of the water. The direct effect on fish of such concentrations of sewage as occur in the Tees at Croft is probably unimportant, and it could be stated definitely that the pollution at this point has no injurious effects on the food supply of the fish. In fact, trout have been caught in the Tees at Croft. In areas of extreme pollution, such as in the Skerne below Darlington sewage outfall, however, there are no fish of any kind. It has been concluded that sewage, in the concentrations in which it occurs in the Tees above Yarm, has a greater effect on the biology of the river by reason of its nutritional value than it has by any direct destructive action.

Dr. B. A. Southgate described the observations and experiments which had been made on the effects of sewage and industrial pollution in the tidal section of the Tees. The estuary receives large quantities of crude sewage and of industrial effluents, mainly in the section from Stockton to Cargo Fleet.

The principal industrial effluents are coke oven effluents containing tar acids, cyanides, etc., and spent pickle liquor, which is an acid solution of iron produced in the cleaning of iron and steel. Oxidation of the sewage and effluents occurs in the estuary at the expense of dissolved oxygen. Large numbers of fish are killed in the estuary, especially salmon and sea-trout smolts during their spring migration to the sea. In 1930 and 1931, the death of migrating smolts was not due to the deficiency of dissolved oxygen, but to cyanides frequently found in lethal concentrations. Other poisonous substances, including tar acids, were not found in toxic concentrations, and it has been concluded, from numerous chemical and physiological experiments and observations, that in the absence of cyanides, migrating smolts would not have been killed in 1930 and 1931. This conclusion marks a distinct step forward, for it has never previously been suggested that cyanides are responsible for the death of fish in the River Tees. Laboratory and semi-technical scale experiments have demonstrated that cyanides in coke oven effluents can readily be converted into relatively non-toxic ferrocyanide by treatment of the effluents with spent pickle liquor and lime.

With regard to the effects of pollution on the biology of the Tees estuary, Mr. W. B. Alexander said that there is a scarcity of living organisms in the middle portion of the estuary of the Tees between Stockton and Middlesbrough. This section is subject to the greatest variations in salinity resulting from tidal flow and to the greatest amount of pollution. In addition, organisms living on the banks must be able to withstand exposure to the air for certain periods at low tide, and those living on the bed of the estuary have to withstand the effects of movement of bottom deposits and of sedimentation. It was impossible to determine, therefore, from a biological survey of the estuary of the Tees only, to what extent the flora and fauna are affected by pollution. A survey of the relatively unpolluted estuary of the Tay had shown a distribution of organisms in the section subject to variations in salinity similar, in general, to the distribution in the corresponding section of the Tees, although there are some differences. It thus appears that the scarcity of plant and animal life in the middle portion of the estuary of the Tees is not primarily due to the effects of pollution.

Mr. R. Bassindale dealt with the differences in range of distribution of certain invertebrate animals in the estuary of the Tees as compared with their range in the unpolluted estuary of the Tay. In water of suitable salinities, tar acids at the maximum concentration found in the Tees are not toxic to the chameleon and common shrimps or to the small amphipods *Gammarus marinus* and *Corophium volutator*. Cyanide at the maximum concentration found in the Tees is toxic, however, to the shrimps but not to the amphipods.

Experiments on the dog crab, which occurs in the most polluted part of the Tees, have shown this organism to be of relatively high resistance to

cyanide. The lack of certain animals in the estuary as food for fish is of secondary importance, as the fish are more susceptible than invertebrates to poisons.

TSEN, EDGAR T. H., and SHIH-HUNG SUNG. **Soy-bean Culture Media.** A Preliminary Report. *The Chinese Med. Journ.*, 1932, xlvi, 601.

This report is the result of an investigation to find a substitute for meat and peptone, which form the principal basis of nearly all culture media, and which would at the same time keep down the heavy expenditure that the production of large quantities of this laboratory essential entails.

After several experiments the medium described below was found to serve the authors best. They state that on the average it is more than forty times cheaper than the ordinary meat-peptone medium, gives good bacterial growth, and retains the original antigenic properties of the bacteria.

Dry yellow soy-bean	100 gm.
NaCl	5 gm.
Agar	15 gm.
Tap water	1,000 c.c.

After each heating and filtration enough tap water is added to the filtrate to make up the volume to one litre.

The beans are soaked in cold water overnight and then ground finely. The original water and the ground beans are mixed, boiled for one hour and filtered through cotton and gauze. Ten per cent of a 1 in 10 dilution of HCl is added to the filtrate, which is boiled for fifteen minutes and filtered through paper. Adjustment is then made to the filtrate with NaOH to pH requirements; it is then heated to about 60° C. for ten minutes and filtered. The NaCl is then dissolved in the filtrate, which is tubed, sterilized and used as soy-bean broth.

Solid medium is prepared by adding fifteen grammes of agar to each litre of soy-bean broth.

Delicate bacteria, such as the gonococcus, meningococcus, etc., require the addition of horse blood to the soy-bean agar, as in the preparation of ordinary meat-peptone blood agar.

Experiments were carried out with sera produced by the immunization of rabbits with various bacteria grown on ordinary meat-peptone agar, which were used for the agglutination test with the same bacteria grown on ordinary meat-peptone agar and those transplanted on the soy-bean agar, daily for twenty and forty-four times.

These experiments showed that bacteria grown on soy-bean agar agglutinated with the two sera in as high dilution as did the same bacteria grown on the ordinary meat-peptone agar.

The authors give figures showing differences in cost of production of ordinary meat-peptone medium and soy-bean medium, which is represented as a difference of from 37·64 to 60·22 times in favour of the latter, and in conclusion state that they have found in the soy-bean a cheap and satisfactory substitute for the expensive peptone and meat.

Reviews.

AN INTRODUCTION TO DERMATOLOGY. By Richard L. Sutton, M.D., Sc.D., LL.D., F.R.S.Edin., and Richard L. Sutton, Jnr., A.M., M.D. London: Henry Kimpton. 1932. Pp. xvi + 565, 183 illustrations. Price 25s. net.

A clear and concise Introduction to Dermatology, well printed and well arranged. This publication by two American authors should prove valuable to officers of the Corps who desire to consult an up-to-date book on the diagnosis and treatment of skin diseases.

The terminology, however, at times strikes an unfamiliar note, for instance "carbunculosis" is new and expressive.

In addition to the usual classification of diseases there is an excellent one based on the distribution and type of eruption which should be helpful in the more obscure conditions.

Numerous prescriptions for ointments and lotions are given and the treatment recommended is on a sound and logical basis.

A short account, chiefly from the diagnostic point of view, is included of the exanthemata and Von Pirquet's opinion is quoted that the eruptive stage of these diseases is really an anaphylaxis and that the prodromal stage corresponds with the time necessary for the development of this allergic manifestation.

The chapter on the diagnosis and treatment of syphilis is in accordance with the accepted teaching in this country, but too much emphasis is placed on the value of mercury, a drug which has, certainly in the Army, been long overshadowed by the superior claims of bismuth.

The illustrations which are very clear and distinct embrace a variety of subjects and the one showing six negroes with elephantiasis of the scrotum must surely be unique! L. B. C.

QUARTERLY BULLETIN OF THE HEALTH ORGANIZATION OF THE LEAGUE OF NATIONS, Vol. I, No. 1, March, 1932. Published by Messrs. Allen and Unwin, London. Price 2s.

This new publication is intended to make the results of the work of the Health Organization of the League of Nations more readily available to readers than has been the case up to now, the results of the various investigations having hitherto been found in scattered reports and minutes of committees.

The *Quarterly Bulletin* is not an official organ and, unless otherwise stated, the Health Organization does not accept responsibility for the opinions expressed.

The number opens with a summary of the conclusions arrived at on the question of immunization against diphtheria. In 1929 a group of experts drew up a syllabus of work to be done on diphtheria immunization on groups of children in various countries, the inquiry being a subdivision of

the work being carried out by the Health Organization of the League of Nations in the investigation and promotion of child welfare. The antigens selected for use were Ramon's formol-toxoid, O'Brien's toxoid, and the Netherlands Serological Institute's toxin-antitoxin.

Results of the investigation were submitted to the League of Nations, and in 1931 a conference of well-known workers in State medicine and serology was held in London to consider the reports and to formulate conclusions. Further resolutions were passed by the conference, and the following is a summary of some of them :—

Immunization against diphtheria, efficiently carried out, effects a great reduction in incidence and mortality of diphtheria among children.

The reactions sometimes seen are not alarming.

It is justifiable to deduce the efficacy of immunization by change of the Schick reaction from + to −, although there are some exceptional cases.

Formol toxoid (anatoxin) appears at present to be the most efficient antigen.

From clinical observation the immunizing power of formol toxoid in man appears to be in relation with the antigenic value of the prophylactic as measured by the flocculation method.

The subcutaneous method of administration is recommended and, if it cannot be performed, application of the prophylactic to the nasal mucous membrane is advised. Cutaneous application was not found to be favourable.

Three injections are advised with the prophylactic at present available, a three weeks' interval being recommended between the first and second injections, and at least two weeks between the second and third.

Schick reactions are considered to be unnecessary before immunization, but it is considered advisable to apply the Schick reaction before and after immunization in a proportion of the subjects for the purpose of estimating the value of the prophylaxis employed.

The most suitable age-period is considered to be after the first year of life and before school age. If children have not been immunized in this period they should be immunized during the first year at school.

As there is no evidence of a negative phase, it is considered that children who have been in contact with a case of diphtheria should be immunized even during epidemics of the disease.

It is advised that in children's homes, holiday camps, institutions for delicate children and such like, a certificate that they have been immunized or are Schick negative should be demanded from all admissions and members of the staff.

It is recommended that all members of the medical, nursing and domestic staff of hospitals, homes, sanatoria, schools, etc., should be immunized.

The public health authorities should educate the public in the advantages of immunization against diphtheria.

The next article is by Sir George Newman on "Medical Education in England." It contains much more than mere information on the education of the medical student and practitioner, for Sir George has given a lengthy summary of the conditions of medical practice in England which will be of interest to all medical men.

The milk supply of North American cities is described by Professor R. Burri, Director of the Swiss Federal Institute for Milk Industry and Bacteriology, Berne, who visited a considerable number of towns in North America. Professor Burri, coming from Switzerland where the regulations for milk supply are the same all over the country, was astonished to find that regulations varied in different States in North America, and he considered that there is need for uniformity in this matter. However, the United States Public Health Service, which has drawn up regulations as to milk, has been endeavouring to have these regulations adopted all over the country, and has been successful in getting them adopted by a considerable number of towns.

Professor Burri describes the conditions of the production and distribution of milk in North America, so far as he was able to see them on his tour.

R. Gautier, formerly Director of the Eastern Bureau of the Health Organization in Singapore, discusses tropical pneumonia. This is an exhaustive article in which symptomatology, bacteriology, ætiology, prevention and the statistics of pneumonia in the tropics are discussed.

The writer concludes that the gravity of tropical pneumonia has not been recognized, although more attention is now being paid to it. He considers that a plan of campaign against the disease should be made by a body of clinicians, bacteriologists and administrative officers.

A second analytical review of reports from Pasteur Institutes on the results of anti-rabies treatment is given by Lieutenant-Colonel A. G. McKendrick, I.M.S.(retd.).

In 1927 the International Rabies Conference in Paris decided that the statistics of institutions in which rabies is treated should be submitted to the Health Organization of the League of Nations, which issues to directors of anti-rabies institutions a schedule, in order that uniformity of reports may be obtained.

In the present paper Lieutenant-Colonel McKendrick considers the reports of work done in 1929 and a few of 1928. The methods of treatment in various institutes are first classified and a table is given of the type of treatment, duration of treatment, number of cases treated, deaths, mortality percentage and paralytic accidents in each of twenty-eight institutes or groups of institutes.

These statistics have been analysed under the following headings: mortality rates, racial statistics, species of biting animal, evidence of rabies in the biting animal, the severity of biting, the intervention of clothing, the position of the bite, the delay in commencement of treatment and paralytic accidents.

Lieutenant-Colonel McKendrick has not been able to find any evidence of a racial susceptibility to rabies, but he finds that non-Europeans have a very much greater degree of risk than Europeans, that they are usually more severely bitten and oftener on the bare skin, that they do not begin treatment so early, and that the biting animal is more frequently rabid.

As regards the efficacy of the various methods of treatment, Lieutenant-Colonel McKendrick considers that the statistics submitted appear to indicate a probable advantage in favour of modified dilution methods of treatment.

The last paper is a report on the floods in China, made by the Medical Director of the Health Organization of the League of Nations on the work undertaken to co-ordinate the campaign against epidemics.

BAILLIÈRE'S SYNTHETIC ANATOMY IN THIRTEEN PARTS. By J. E. Cheesman. London: Baillière, Tindall and Cox. Price of complete work in loose-leaf binding case, 42 shillings net.

By the completion of Part X—"The Brain"—the author brings his remarkable and original atlas of anatomy to a successful conclusion. The twelve coloured plates of this section are printed on transparent paper and accompanied by a key index in conformity with the other twelve parts of this work.

In this most difficult section, Dr. Cheesman fully maintains the high standard which he has successfully realized throughout.

The completed publication numbering 156 plates, with a key index to each section, is conveniently contained in a neat loose leaf binding case measuring only 7½ × 9 in. It should make a special appeal to the surgeons of the Services, since the anatomy of the whole human body is presented in a fresh light, rarely encountered outside a dissecting room, and collected in a most portable form.

The novel possibilities associated with the possession of Baillière's "Synthetic Anatomy" include the projection of transverse sections of any part at any desired level; the exact localization of any desired point by means of scales provided on the key index; the production of stereoscopic effects by combination of two or more plates, and the ready enlargement of any given tracing. G. M.

Correspondence.

B.P.V.-DEFICIENCY AND *ASCARIS* IN RELATION TO PELLAGRA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I was most interested to read, in your Editorial on the latest annual report of the Lister Institute of Preventive Medicine, of certain work recently done bearing upon the question of the biological protein value (B.P.V.) of maize. The results, if confirmed, show that this is by

no means low—rather the contrary—and hence give no support to the view that pellagra is essentially due to a low B.P.V. of maize as food. This appears to be a serious blow to the chief conclusion of the Pellagra Commission on the Turkish prisoners of war (1918-1919), on which I had the honour to serve. In a long letter to the *Lancet* (1920, i, p. 1193), I discussed this question in detail and gave my reasons for considering that infection with *Ascaris* constituted probably a *most important factor* in the causation of this disease. This factor may be either the action of the toxins of this helminth, or the utilization by the worms of certain essential elements in the digested food (to the consequent deprivation of the host), or both effects combined. In addition to my own parasitological observations, I should add that my view was strengthened, in my opinion, by the work and opinions of others, notably Bigland and Enright (on the occurrence of pellagra in German prisoners, in whose case there was certainly no question of B.P.V.-deficiency), Stewart (on biological points in connection with the development of the worms), and Bedson (on the toxicity of *Ascaris*), which were there outlined (*loc. cit.*). It is worth noting also that Roaf, who was another member of the above-cited Commission and then supported the B.P.V.-deficiency view, later, in his "Textbook of Physiology" (1924), distinctly qualified this opinion. He says there: "It must be remembered that it is not the amount eaten, but the amount absorbed, which is the essential factor." This is a very different matter. Hence, for the above reasons, I am now more than ever inclined to regard *Ascaris*-infection as the principal cause of pellagra.

October 24, 1932, I am, &c.,
Walton-on-Thames. H. M. WOODCOCK.

Notices.

HIGH QUALITY MILK BONUS.

FOR a long time the Directors of Cow and Gate, Ltd., have been desirous of making some financial recognition of high quality and special care in the handling of their milk by suppliers to the company, as they feel progress in quality production is of vital national importance.

An experimental Scheme was put into operation at one Branch in June last, and the scheme set out below will be adopted at all West of England Branches as from October 1, 1932.

Each supplier's milk will be graded by a system of marks, and each month ten per cent of farmers gaining the greatest number of marks will be paid 1d. extra per gallon for the month's supply. The twenty per cent of farmers gaining the next highest marks will be paid ½d. per gallon extra.

Marks will be awarded as follows, the numbers given being the

maximum obtainable in each case: Butter fat, 400 marks; solids other than fat, 100 marks; bacterial count, 400 marks; visible sediment, 100 marks.

Deliberate adulteration of any sort will disqualify a supplier from receiving a bonus, no matter what marks are obtained.

The Scheme will be amended in any way that experience shows to be desirable. Suppliers will be advised of any change in the method of scoring. Every endeavour will be made to keep the Scheme absolutely fair and to eliminate all factors which will tend to give any particular supplier or suppliers a better chance of obtaining a bonus than the remainder.

As an example of the financial benefit, a supplier sending 100 gallons a day and obtaining a penny bonus will receive £12 10s. in addition to standard prices for his month's milk. Small and large suppliers stand equal chances of obtaining bonuses, and good results depend almost entirely upon good management rather than on any financial outlay.

LIST OF BOOKS RECEIVED AT THE ROYAL ARMY MEDICAL COLLEGE LIBRARY DURING THE PERIOD JULY 1 TO SEPTEMBER 30, 1932.

Author(s)	Title of Work	Grant or Not
Haldane	Respiration	Grant
Buscher	Grün und Gelbkreuz	,,
Riley & Johnson ..	Medical Entomology	,,
Adler	Understanding Human Nature	Captain J. E. Gray
Ministry of Health ..	Final Report on Maternal Mortality and Morbidity	Ministry of Health
Bailey	Physical Signs in Clinical Surgery	Grant
Sutton & Sutton ..	An Introduction to Dermatology	,,
Hadfield & Garrod ..	Recent Advances in Pathology	,,
Renshaw	Laboratory Service and the General Practitioner	,,
Crowe	Vaccine Treatment of Chronic Rheumatic Diseases	,,
McQueen	Our War	Author
Britton	Hydrogen Ions	Grant
Russell	Colonic Irrigation	,,
Bailey & Love	A Short Practice of Surgery, Vol. I	,,
Bumpus	Minor Surgery of the Urinary Tract	,,
Buie	Proctoscope Examination and the Treatment of Hæmorrhoids and Anal Pruritus	,,
Scott	Sex and its Mysteries	,,
League of Nations ..	Preventive Measures against Dangers resulting from the use of Radium, Roentgen and Ultra-violet Rays	,,

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C.N. = Clinical and other Notes.
C.L. = Current Literature.

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ASSISTED BY

LIEUTENANT-COLONEL A. DAWSON, R.A.M.C.

MANAGER:

MAJOR J. M. MACFIE, M.C., R.A.M.C.

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Journal
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Original Communications.

INVESTIGATIONS INTO CASES OF CEREBROSPINAL FEVER IN THE NORTHERN COMMAND OF THE ARMY DURING 1931, CONCLUDING WITH A PLEA FOR THE EARLY DIAGNOSIS OF THE DISEASE.

BY MAJOR W. WALKER, M.C.,
Royal Army Medical Corps.

(*Continued from vol. lix, page* 409.)

LABORATORY TECHNIQUE.

Media Employed.

Pea-trypagar was obtained in bulk from the Pathology Department, Royal Army Medical College, London. Before use, a saline dilution of human blood was added as enrichment. This was prepared by adding ten cubic centimetres of blood to 100 cubic centimetres of saline in a flask and then ten cubic centimetres of ether; the whole was agitated until complete hæmolysis had taken place. This blood dilution was added at the rate of five per cent to the trypagar, previously melted in the steamer and cooled to 50° C. It was found that without the enrichment there was a long "lag" period during which no growth was apparent in plates inoculated at a considerable distance from the laboratory. On this medium the meningococcus colonies have a characteristic appearance. In a twenty-four-hour culture the colonies average about one millimetre in diameter, while in a forty-eight-hour culture they may increase up to three millimetres. For primary subculture blood-trypagar slopes were used as it was found by experience that plain trypagar was not absolutely reliable for this purpose. Subsequent cultures grew readily on the stock trypagar. Egg-medium

was found satisfactory for maintaining cultures over long periods and for transmitting cultures by post.

Plates were carried to the cases in cylindrical metal containers provided with a water-jacket, the whole being conveyed in felt-lined boxes. The warm carriers lost heat at the rate of from 3° C. to 6° C. an hour, depending on the intensity of the weather.

The Isolation of the Meningococcus.

(*a*) *From the Cerebrospinal Fluid.*—At first it was the practice to make cultures from the cerebrospinal fluid only at the bedside, twelve to fifteen large loopfuls being spread over each plate. It was found that when relatively few meningococci were visible in stained deposits from the fluid, the isolation of the meningococcus was not always assured by this method of plating. The method subsequently adopted was: (*a*) to plate at the bedside; (*b*) to spin a portion of the fluid and plate out the deposit; (*c*) to incubate another portion of the fluid overnight at 37° C., the fluid acting as a culture medium. If no growth was apparent on (*a*) and (*b*) plates after eighteen to twenty-four hours the deposit from (*c*) was inoculated on to further plates. I have not yet been able to obtain a growth of meningococci from cerebrospinal fluid incubated overnight when the other cultural methods were unsuccessful.

Of the twelve cases, cultures from nine only were investigated in the Command Laboratory. Cultures made from the cerebrospinal fluid at the diagnostic lumbar puncture of the nine cases resulted in the isolation of the meningococcus in five cases. In three out of the four unsuccessful cultures the cerebrospinal fluid was clear. In the stained deposits from the fluids one case showed no organisms, one a single pair only of diplococci, while in the third only a very occasional meningococcus was seen after a prolonged search. In the remaining case the fluid was slightly turbid but the organisms seen were rare and mostly intracellular.

(*b*) *From the Nasopharynx.*—West's swabs were employed for removing material from the nasopharynx. After a little practice no difficulty was experienced in passing the covering tube up behind the soft palate and in swabbing the upper posterior portion of the pharynx of contacts, carriers and individuals suffering from simple catarrhal pharyngitis. The established case of ceresbropinal fever was difficult to swab. He often lay huddled up in bed. In his apathy he made little attempt to open his mouth. Some degree of nausea was usually present, so that when the covering tube of the swab touched the back of his tongue retching very frequently resulted. There was hypersensitiveness of the fauces and soft palate, so that when these structures were touched explosive coughing often resulted.

The material from the swabbing was at once conveyed to warm trypagar plates. The swab was rubbed lightly over a small portion of the medium at the edge of the plate; the material was then spread by charging a platinum

loop from this area and making ten or twelve strokes across the medium, recharging and spreading being twice repeated. In this way an even, but not too luxurious, growth was obtained. The plates were examined after twenty-four hours and again after forty-eight hours' incubation. It was found that many of the contacts, on first swabbing, produced pure, or almost pure, plate cultures. Cases of meningococcal pharyngitis produced typically pure plate cultures.

Established cases of cerebrospinal fever produced, as a rule, very few meningococcus colonies. There was frequently a heavy overgrowth of *Staphylococcus albus,* alone or associated with streptococci. In one only out of nine known cases swabbed have I been able to recover the meningococcus in anything like a pure culture. So constant was the finding of a mixed culture of many *S. albus* and few meningococcus colonies from the nasopharynx of bacteriologically diagnosed cases of cerebrospinal meningitis that when it came to differentiating that disease from an acute meningococcal pharyngitis, the greater the number of meningococcus colonies found in the nasopharyngeal culture the more likely was the disease to be a simple pharyngitis.

Serological Tests.—At the outset an attempt was made to type all meningococci, both spinal and nasopharyngeal, isolated. The results were so unsatisfactory that attempts at typing were limited to meningococci isolated from cases of the disease. The typing serums available appeared to be lacking in type specificity. Many meningococci failed to agglutinate, others agglutinated to an equal titre with two of the typing serums, while others did so with more than two. The recent Ministry of Health review on cerebrospinal fever [1] calls attention to this difficulty in present-day differentiation of the four serological types, and attributes it to the deterioration of the strains now in use for the preparation of typing sera, since their isolation during the last great epidemic. Hood and Little,[2] during the Aldershot outbreak, experienced the same difficulty when dealing with the organisms isolated.

In carrying out the agglutination tests, eighteen- to twenty-four-hour cultures on trypagar were washed off with sterile saline, and were heated to 65° C. for thirty minutes and afterwards diluted down to 2,000 million organisms per cubic centimetre. During the test they were left in the water-bath at 55° C. for twenty-four hours. Gordon's standard technique[3] and Dreyer's method were tried, but the final results were unsatisfactory in both.

[1] Reports on Public Health and Medical Subjects, No. 65, Ministry of Health, London, 1931, pp. 11 and 18.

[2] Armstrong, C., Fotheringham, J. B., Hood, A., Little, C J. H., and Thompson, T. O.: "Cerebrospinal Fever in the Aldershot Command," JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, London, 1931, lvii, pp. 335 and 337.

[3] Gordon, M. H. "Studies in the Bacteriology, Preventive Control, and Specific Treatment of Cerebrospinal Fever among the British Forces," 1915-19, Medical Research Committee, Special Report Series, No. 50, 1920, p. 54.

It thus came to pass that in dealing with organisms from the nasopharynx it was not possible to differentiate the true epidemic strains of the meningococcus from their harmless brethren of identical cultural characteristics and morphological appearance. It naturally follows that, undoubtedly, many innocent individuals were labelled meningococcus carriers and compelled to undergo the discomforts of isolation who were, in reality, merely harbouring a non-pathogenic Gram-negative diplococcus. Again the carrier rates of untyped meningococci can only be taken as relative.

Meningococci isolated from the cerebrospinal fluid of cases gave the following results on serological examination: Type I meningococcus, 2 cases; Type II meningococcus, 1 case; inagglutinable strains, 2 cases.

The occasional typing of nasopharyngeal meningococci resulted in the following findings: Type I (or Type I-III), 6; Type II, 2; Type IV, 1.

The Clinical Investigation of Cases.

Two of the twelve cases were not available for investigation as they had been sent direct to local infectious diseases hospitals on purely clinical grounds. The remainder were investigated from the Command Laboratory, nine by the writer and one by Major R. W. Swayne, O.B.E., Medical Specialist, York, to whom I am indebted for a copy of his notes on the case.

After some experience was acquired regarding the difficulties in diagnosis in early cases of the infection, a systematic scheme for the investigation of all such cases was made out and subsequently applied to all suspected cases. The information collected regarding the earlier cases is not complete in many details. The scheme of investigation included the following:—

(1) *Information from the Patient.*—The nature of the complaint, its duration and mode of onset—this last being gone into very carefully. Any recent catarrhal or influenzal-like infection? Any vomiting?

(2) *Clinical Examination of Patient.*—Temperature, pulse and respiration noted. General appearance, toxic or otherwise. Mental attitude. Rash: if present, its character and extent. Headache: its severity, location and persistence. Throat: condition of fauces, soft palate and pharynx, degree of catarrh, hæmorrhagic spots. Mouth: tongue. Neck: pain, tenderness, discomfort, stiffness, limitation of movements, retraction. Abdominal reflexes and knee-jerks: normal, exaggerated, sluggish or absent. Kernig's sign: absent, frankly positive, suggestion of.

(3) *Special Examinations.*—Nasopharyngeal swab for culture. Direct smear from nasopharynx, stained by Gram's method, for immediate examination.

Blood examination, total and differential white blood-cell count.

At this point advise as to further procedure. If indicated proceed to:—

Lumbar puncture. Note: pressure, appearance and amount of cerebrospinal fluid withdrawn.

Examination of fluid :—

(1) At bedside: For globulin, Nonne-Apelt test ; for glucose, reduction of Fehling's solution. Culture of fluid at bedside.

At this point decide on the advisability of giving anti-meningococcus serum ; if in any doubt whatsoever, give serum.

(2) Laboratory tests.

Cell count.

Type of exudate, if any, as seen in stained smears from deposit.

Organisms, if any, seen in smears ; their location.

Culture of fluid from deposit. Incubation of portion of fluid for future culture.

Blood-culture in the presence of profound toxæmia associated with clear cerebrospinal fluid.

A brief résumé of the findings expressed in percentages, reduced to round numbers, reads as follows :—

In 80 per cent of cases there is a history of a catarrhal or influenza-like onset, in 80 per cent the outstanding initial symptom is headache, in 70 per cent there is vomiting, and in a like percentage there is sore throat.

After twenty-four to forty-eight hours, 65 per cent of cases have pyrexia, but in only 55 per cent is there a relatively slow pulse at this stage; 90 per cent exhibit a toxic appearance and in 65 per cent the outlook is apathetic. Every third case exhibits a rash of some description. Headache and pharyngitis are present in every case. All patients complain of neck symptoms in some degree; in 75 per cent these are confined to pain, stiffness, limitation of movement or mere discomfort. Head retraction is present in 25 per cent at this stage. In 55 per cent the abdominal reflexes are either diminished or absent, in the remainder they are exaggerated. In about 55 per cent the knee-jerks are exaggerated, in 25 per cent sluggish or absent. Kernig's sign is present in some degree in 65 per cent of all cases, but only in 45 per cent is it definitely positive.

Turning to the cerebrospinal fluid. At this stage the fluid is definitely under pressure in 65 per cent at the diagnostic lumbar puncture. In 45 per cent the fluid is definitely turbid, and in 55 per cent the cell count is increased, and meningococci can be demonstrated in stained smears prepared from the deposit, the majority being extra-cellular. Cultures made from the fluid within twenty-four to forty-eight hours of the onset of the disease may only be successful in about 45 per cent of the cases. From the naso-pharynx the organism should be isolated in over 50 per cent of cases at the first attempt.

Total and Differential White Blood-cell Counts.—A leucocytosis is constantly present in every case of cerebrospinal fever. In six cases diagnosed bacteriologically in which a blood-count was done within twenty-four to forty-eight hours of the onset, the white blood-cells lay between 15,800 and 21,000 per cubic millimetre. In no case was a lower total

white blood-cell found. No cell counts have been done on cases of over forty-eight hours' duration.

In the differential white blood-cell counts carried out at the same time, the polymorphonuclear leucocytes, in four out of the six cases, lay between 83 per cent and 90 per cent. In one case the percentage was 60 and in another it was 65. The former was associated with a leucocytosis of 15,800 and the latter with one of 19,000.

The Cerebrospinal Fluid Cellular Exudate.—In order to determine the type of exudate in cases, films made from the fluid deposit, after spinning, were allowed to dry at air temperature and, after fixing with alcohol for two minutes, were stained by Leishman's method. In all cases the exudate was polynuclear in type, the percentage ranging between eighty per cent and ninety-five per cent, the remainder being about equally divided between lymphocytes and large endothelial cells. Occasionally cells were seen resembling small nucleated red cells, the nucleus sometimes being single, sometimes in two or three large fragments. This method of staining showed up the meningococcus very well. Smears stained by Gram's method were also prepared at the same time in order to determine the staining reaction of any organism seen by the first method.

The Globulin Content of the Cerebrospinal Fluid.—The Nonne-Apelt test for determining the presence of globulin in excess in the cerebrospinal fluid was employed. The test was done at the bedside as an additional aid to the diagnosis of the case, the important point being the giving or withholding of specific anti-serum. It was found that with the faintest trace of turbidity the test was strongly positive. With an apparently clear fluid, but having a cell count of about fifty cells per cubic millimetre, there was a definite reaction. In one case, with the fluid crystal clear, a faint delayed ring at the junction of the fluid and the ammonium sulphate solution was observed. On doing a fluid cell count in this case, only two cells per cubic millimetre were estimated. The deposit obtained on spinning for fifteen minutes showed a few polynuclear cells and an occasional meningococcus. With a clear fluid a negative Nonne-Apelt must not be the deciding factor for the withholding of anti-meningococcus serum in the face of other definite indications of early meningococcus meningitis.

The test is more delicate than the Fehling test for detecting the diminution in the glucose content of the cerebrospinal fluid. In the case of the faint delayed ring, recorded above, there was a normal reduction of Fehling's solution.

Glucose in the Cerebrospinal Fluid.—Normal cerebrospinal fluid contains, on the average, one hundred milligrams of glucose in one hundred cubic centimetres of the fluid. A sample of normal fluid will completely decolorize a quarter of its volume of Fehling's solution. To carry out the test, the Fehling's solution was diluted to four times its original volume. One volume of the cerebrospinal fluid to be tested was added to one volume

of the diluted solution and the resulting mixture boiled. A trace of the original blue remaining indicates a definite reduction in the amount of glucose present in the fluid. No alteration in the colour of the mixture indicates a very considerable reduction. It was found that clear cerebrospinal fluids were invariably associated with a normal reduction of Fehling's solution. In turbid fluids there was no trace of reduction. The test, therefore, as an additional aid to diagnosis, is of no real practical value.

Clinical Aspect of Cases.

The types of cases encountered can be classified into three main groups :—

Group	Number of cases	Mortality in the acute stage of the disease
1. Very acute cases. (Survived 72 hours to die within 5 days)	4	100 per cent
2. Acute cases	4	50 per cent
3. Sub-acute cases	4	*Nil*

One case, the child, survived the acute stage but died after a chronic illness lasting over four months.

All cases but one received polyvalent anti-meningococcus serum at the diagnostic lumbar puncture. After this, the cases left our hands, further treatment being carried out at the various civil infectious diseases hospitals.

In eleven cases the diagnosis was bacteriologically confirmed ; in one case the diagnosis was based on clinical evidence only.

The following cases are examples of some of the types encountered :—

(1) *An Acute Case with a Typical Onset.*

History of being taken suddenly ill during the night, the outstanding symptom being an acute headache. Later he vomited several times. He reported sick after twenty-four hours and was admitted to hospital. Next morning the temperature was 98° F., the pulse 80. He complained of severe frontal headache, pain and stiffness in the neck and backache. He had vomited several times. He looked extremely ill and toxic, and lay in a condition of apathy. There was a petechial rash over the arms and trunk. The pharynx was acutely catarrhal. The head was slightly retracted, the abdominal reflexes and knee-jerks were exaggerated. Kernig's sign was definitely positive.

A culture was made from the nasopharynx.

A lumbar puncture was then made, under a general anæsthetic. The cerebrospinal fluid was under great pressure and was very turbid in appearance; forty cubic centimetres were withdrawn and thirty cubic centimetres of polyvalent anti-meningococcus serum were injected intrathecally.

Laboratory findings. Cerebrospinal fluid : cell count, 23,000 cells per cubic millimetre. Type of exudate : ninety-five per cent polynuclear Organisms : numerous meningococci seen, mostly extra-cellular. Culture :

heavy growth of meningococci; inagglutinable, type not determined. Nasopharyngeal culture: meningococci present in practically pure culture. (This was the only occasion in which this type of culture was obtained from the nasopharynx of a bacteriologically proved case of the disease.)

The case died on the fifth day after the onset of the disease.

(2) *A Very Acute Case with an Atypical Onset.*

The case was taken suddenly ill in the morning with severe headache and generalized body pains. He soon developed rigors and vomited twice. At noon he reported sick and was admitted to hospital; his temperature was 101° F., and pulse 116. There were no nervous symptoms. He was treated as a case of influenza. He vomited his medicine twice, but otherwise there was no spontaneous vomiting. Later in the day he developed a few petechial spots on the trunk. He spent a comfortable night. Next morning he confessed to feeling more comfortable. Temperature 98° F., pulse 100. There had been no more vomiting. He looked very toxic and was generally apathetic. There were numerous petechiæ over the trunk and arms. The pharynx was acutely catarrhal. He complained of discomfort in the neck, but no stiffness or retraction was made out. The abdominal reflexes and knee-jerks were present but sluggish. Kernig's sign was frankly negative.

A culture was made from the nasopharynx.

A lumbar puncture was then made. The fluid was under slight pressure. It was crystal clear; twenty cubic centimetres were withdrawn. Anti-meningococcus serum was most unfortunately withheld.

Laboratory findings. Cerebrospinal fluid: cell count, six cells per cubic millimetre. Type of cell: all lymphocytes. Organisms: none seen in films from the deposit. Culture: sterile. Nasopharyngeal swab: a mixed growth, mostly *Staph. albus*, with a few colonies of meningococci.

Next morning he became suddenly worse. He complained of severe headache; was very restless and later became delirious. There was definite head retraction. Kernig's sign was definitely positive.

A second lumbar puncture was done. The fluid was under much pressure. It was fairly turbid; fifty cubic centimetres were withdrawn and forty cubic centimetres of polyvalent anti-meningococcus serum were injected intrathecally.

Laboratory report: Cell count, 23,000 cells per cubic millimetre. Type of exudate: approximately ninety-five per cent polynuclears. Organisms: numerous meningococci present, all seen were extra-cellular. Culture: heavy growth of meningococci. Serological type: Type I.

The patient died within ninety-six hours of the onset of the disease.

(3) *An Atypical Mild Case Diagnosed Bacteriologically.*

Admitted to hospital in the forenoon complaining of pharyngitis; temperature 100° F., pulse 90. Next day, temperature 100·2° F., pulse 96.

Acute catarrhal pharyngitis and bronchitis present. Complains of frontal headache and slight stiffness of neck. No limitation of neck movements. Abdominal reflexes and knee-jerks apparently normal. Kernig's sign absent.

The following day, temperature 100·6° F., pulse 100. Looks toxic. Vomiting and epistaxis had occurred. Headache more severe. Neck stiff but no retraction; abdominal reflexes and knee-jerks absent. Kernig's sign definitely negative.

A culture was taken from the nasopharynx.

Lumbar puncture was done. Cerebrospinal fluid was under pressure and turbid; forty cubic centimetres escaped. Thirty cubic centimetres of polyvalent anti-meningococcus serum were injected intrathecally.

Laboratory report. Cerebrospinal fluid: cell count, not done. Exudate: moderate number of cells found in the deposit. Approximately ninety per cent polynuclears. Gram-negative diplococci seen, the majority intracellular. Culture: sterile. Nasopharyngeal swab: a mixed growth with a few meningococcus colonies present, overgrowth of staphylococci.

(4) *A Mild Case Diagnosed Clinically.*

Patient felt fit until one morning when he developed a headache and sore throat. He vomited once. At noon he reported sick and was admitted to hospital. Temperature 103° F., pulse 80. He had a very toxic appearance. There was no rash visible. There was an acute catarrhal inflammation of the pharynx and the tongue was very dirty. These was no neck stiffness or head retraction, but the patient complained of some pain in the neck muscles. The abdominal reflexes and knee-jerks were absent. Kernig's sign was definitely positive.

A culture was taken from the nasopharynx. A direct smear, stained by Gram's method, showed a mixed infection with many Gram-negative diplococci.

Blood examination: total white blood-cell count, 16,400 cells per cubic millimetre. Differential count: polymorphonuclears, 84 per cent; lymphocytes, 12 per cent; monocytes, 4 per cent.

A lumbar puncture was undertaken. The cerebrospinal fluid was under great pressure; it was crystal clear; fifty cubic centimetres were taken off, and forty cubic centimetres of polyvalent anti-meningococcal serum were introduced intrathecally.

Laboratory findings. Cerebrospinal fluid: cell-count, five cells per cubic millimetre. Type of cell: all lymphocytes. Organisms: none seen. Culture: sterile. Nasopharyngeal swab: mixed growth, no meningococcus colonies present.

He was removed to the local infectious diseases hospital within two hours of the lumbar puncture. I went to that hospital next day to ascertain if any further developments had taken place. I found the patient covered with a profuse petechial rash. No further lumbar puncture had

been or was done during his stay in hospital. He was acutely ill for four days, after which he rapidly recovered.

The accuracy of the diagnosis appears to be fairly certain. There was a contact carrier rate of twenty-three per cent in the barrack hut occupied by him prior to the onset of his illness.

Differential Diagnoses.

During the course of these investigations many cases, other than meningococcus meningitis, were encountered. Over twenty-five such cases were seen, but, as the investigation of many did not get beyond a white blood-cell examination, detailed records of all the cases examined were not kept.

Examples from the various groups of cases are given below, with appropriate reasons for withholding a diagnosis of cerebrospinal fever.

Types of Cases :—

(1) Acute meningococcus pharyngitis with meningismus, 6 cases; (2) influenza with toxæmia and meningismus, 2 cases; (3) tuberculous meningitis, 1 case; (4) primary pneumococcal meningitis, 1 case; (5) septic meningitis, 2 cases; (6) pharyngitis due to Friedlander's pneumobacillus, 6 cases; (7) glandular fever, 1 case.

(1) *Acute Meningococcus Pharyngitis with Meningismus.*—The differentiation of this condition from that of early meningococcus meningitis is, on occasions, extremely difficult. Increasing experience only adds to the difficulty in that it demonstrates, beyond a doubt, that these two conditions are but different manifestations of one and the same infection, the natural resistance of the individual, on the one hand, and the virulence of the infecting organism, on the other, being the determining factors in deciding whether the infection is to remain localized in the nasopharynx or whether it will proceed to invade the underlying tissues, and either precipitate a septicæmia or, by simple extension, proceed to invade the meninges of the brain. The burden of responsibility is not lessened by the knowledge that a mistake, either way, may lead to serious consequences to the individual, if his early meningitis remains unrecognized, even for a few hours, or to the community, if the lesser malady is diagnosed the graver, entailing, as it does, the isolation and swabbing of contacts, the segregation and treatment of the unfortunate carriers, mass apprehension, official uneasiness, press publicity, to say nothing of all the additional paper work involved.

The question of the differential diagnosis of the two conditions will be fully discussed in Section II, when the subject of the early diagnosis of cerebrospinal fever is approached.

Example of this type of case :—

The man had been attending sick for past three days with a sore throat. Next morning, as he was feeling better, he was returned to duty. In the evening he suddenly developed a headache, and later on vomited twice.

He reported sick the following morning, complaining of headache, sore throat, and stiffness of neck. Temperature, 98·2° F., pulse 80. He had a flushed, toxic appearance. There was an acute catarrhal pharyngitis present. The neck muscles were tender, and there was a slight degree of stiffness on moving the head backwards and forwards. The abdominal reflexes and knee-jerks were exaggerated. There was a suggestion of Kernig's sign. Patient was detained for observation. Nasopharyngeal swab was taken for culture and for direct examination. In the direct smear, pus cells and many Gram-negative diplococci were observed. Culture gave pure growth of meningococci. Blood-examination: Total white blood-cell count, 10,200 cells per cubic millimetre. Differential count: Polymorphonuclears, 70 per cent; lymphocytes, 25 per cent; monocytes, 3 per cent; eosinophils, 2 per cent.

After eight hours: Total white count, 14,200 per cubic millimetre. Differential white count: Polymorphonuclears, 76 per cent; lymphocytes, 19 per cent; monocytes, 4 per cent; eosinophils, 1 per cent. Patient looked very toxic. Slight increase in neck stiffness, suggestion of Kernig's sign persisted. Knee-jerks brisk, abdominal reflexes rather sluggish.

Following morning: Patient stated that he felt much better. Temperature 98° F., pulse 80. Looked less toxic and general outlook brighter. He only had a pain in the head when he coughed. There was still some stiffness in the neck, but no pain was present. The abdominal reflexes were sluggish, the knee-jerks appeared to be normal. There was still a trace of Kernig's sign. Blood-examination: Total white blood-cell count, 9,800 cells per cubic millimetre. Differential count: Polymorphonuclears, 69 per cent; lymphocytes, 27 per cent; monocytes, 4 per cent; basophils, 1 per cent.

Next day he was much better and the nervous symptoms had almost cleared up.

Here the line of action was to watch the degree of leucocytosis. This did not reach the 15,000 mark. The finding of meningococci in practically pure culture was more in favour of a simple meningococcus pharyngitis. For these reasons a lumbar puncture was withheld.

(2) *Influenza with Toxæmia and Meningismus.*—In the absence of cerebrospinal fever this type of case does not attract much attention, but when the meningococcus is abroad it assumes some degree of importance on account of the outward similarity of its symptoms to those of early meningitis.

Pyrexia and a relatively fast pulse are the rule. The pharyngeal symptoms are not so prominent or they may be altogether absent. There is generally a leucopenia with a relative lymphocytosis.

Example of this type of case:—

There was a history of sudden onset with rigors, headache, nausea, but no vomiting. The headache was very severe and paroxysmal in character. There was no catarrhal throat condition or cough. When seen next day the temperature was 102° F., the pulse 120. Patient complained of severe occipital headache and pain in neck muscles, and looked toxic. The throat

appeared to be healthy. There was discomfort on moving the head, but no stiffness was present. Abdominal reflexes were sluggish, knee-jerks brisk, suggestion of Kernig's sign in both legs. Blood examination: Total white blood-cell count, 6,500 cells per cubic millimetre. Differential count: Polymorphonuclears, 78 per cent; lymphocytes, 29 per cent; monocytes, 4 per cent. Under the circumstances, no lumbar puncture was done. Cerebrospinal fever was definitely excluded. A diagnosis of acute influenza, with meningeal irritation, was made. The patient completely recovered in a few days.

(3) *Acute Tubercular Meningitis.*—This disease is rarely encountered in the wards of military hospitals. A fuller account of the case has been recorded elsewhere.[1]

The man was admitted with constipation and headache. Temperature 100·2° F., pulse 76, respirations 20. He developed pain in the neck. He vomited after meals. Abdominal reflexes were present, knee-jerks were absent. There was a suggestion of Kernig's sign in both legs. He lay on his side with his head retracted.

Blood-examination: Total white blood-cell count, 10,200 cells per cubic millimetre. Differential white blood-cell count: Polymorphonuclears, 78 per cent; lymphocytes, 18 per cent; monocytes, 4 per cent.

A lumbar puncture was made. The cerebrospinal fluid was under pressure and turbid; 35 cubic centimetres escaped; 25 cubic centimetres of polyvalent anti-meningococcus serum were injected intrathecally.

Report on fluid: Cell count, 175 cells per cubic millimetre. Type of exudate: over 95 per cent lymphocytes. Organisms: tubercle bacilli found in films stained by the Ziehl-Neelsen method.

The finding of the tubercle bacilli immediately established the diagnosis. Apart from the finding of the bacilli, the extreme type of lymphocytic exudate definitely ruled out meningococcus infection.

(4) *Acute Primary Pneumococcal Meningitis.*—This is also a rare disease to encounter in military medical practice. In its onset and course the disease is indistinguishable from acute cerebrospinal fever.

History of sudden onset with headache and vomiting on previous evening. Next morning, temperature 102·6° F., pulse 104. There was severe headache and frequent vomiting. He looked extremely toxic and was mildly delirious and very irritable. The neck was stiff and the head slightly retracted. Reflexes were difficult to elicit as the patient lay in bed with both legs acutely flexed at the knees and hips. A lumbar puncture had been done by Major E. P. N. Creagh, Medical Specialist, Catterick, before my arrival, and anti-meningococcus serum had been given. The cerebrospinal fluid was found to be under great pressure and very turbid. A cell count was not done. Films made from the deposit showed a heavy exudate

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[1] Walker, W., O'Meara, F. J.: "Apparent Recovery from an Attack of Acute Tubercular Meningitis," JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, London, 1932, lviii, p. 50.

of cells, polynuclear in type. Pneumococci were seen in clumps within pus cells, occasional extra-cellular cocci occurred. Globulin was present in excess in the cerebrospinal fluid. There was no reduction of Fehling's solution.

The finding of pneumococci facilitated the exclusion of meningococcus infection. Apart from the finding of pneumococci in this condition, cerebrospinal fever could be excluded by the fact that no meningococci were found in a fluid teeming with pus cells obtained on diagnostic lumbar puncture.

(5) *Acute Septic Meningitis. Two cases.*—The onset was vague in the first case, the predominating symptom being severe headache. He was admitted to hospital with a temperature of 99° F., pulse 90. He was very irritable and inclined to be delirious. There was definite head retraction and Kernig's sign was frankly positive. The patient vomited frequently. A lumbar puncture was done. The cerebrospinal fluid was under much pressure and was very turbid. A fluid cell count was not done. Stained films made from the deposit revealed a heavy exudate of polynuclear cells. No organisms were found after a prolonged search. The fact that no meningococci were found in a fluid teeming with pus cells appeared to exclude the possibility of meningococcus infection. This diagnosis was withheld. The patient died within forty-eight hours. The post-mortem examination revealed a right frontal cerebral abscess of streptococcal origin.

The other case gave a history of sudden onset with headache, pain in the back and in the right shoulder. He became progressively worse. Definite signs of pneumonia appeared in the right lung. The backache, not localized, increased. Head retraction and spasticity of the legs rapidly developed. The knee-jerks were excessive; Kernig's sign was frankly present. There was a gradual ascending line of anæsthesia in both legs. The total white blood-cell count was 35,000 cells per cubic millimetre, with a differential count of 90 per cent polynuclears, 7 per cent lymphocytes, and 3 per cent monocytes. A lumbar puncture was done. The fluid was not under pressure and was bright yellow in colour; twenty cubic centimetres were withdrawn. There was a cell count of seven cells per cubic millimetre. Films from the deposit showed occasional lymphocytes. No organisms were seen. A guarded diagnosis of a pressure lesion of the cord was given. The man died two days afterwards. The post-mortem report stated that the body of the seventh cervical vertebra was the seat of an acute osteomyelitis. The meninges and cord were acutely inflamed above the level of the bone lesion. Pus had collected in the posterior mediastinum and was tracking forward. A portion of the cord was received in the laboratory and from it *Staph. aureus* was isolated.

(6) *Acute Pharyngitis with Septicæmia and Meningismus due to Friedlander's Pneumobacillus.*—One evening, six men from one barrack hut were admitted to the Military Hospital, Catterick, with symptoms suggestive of

a common infection of an acute nature. All appeared toxic in some degree and all were complaining of headache and sore throat. Three had pyrexia varying from 100° F. to 103° F., the remainder were apyrexial. All showed symptoms of meningeal irritation in some degree, in two cases it was very pronounced. One case showed symptoms of early pneumonia in the right lung. The orderly medical officer performed a lumbar puncture on two of the more severe cases, which included the one with symptoms of early pneumonia. In the latter case, anti-meningococcus serum was given. In both cases he found the cerebrospinal fluid under moderate pressure, and crystal clear, the cell content being within normal limits and the type lymphocytic. In the fluid deposit of one case no organisms were seen, in that of the other many Gram-negative coccobacilli were observed. These lay either singly or in pairs, end to end. There were also other and larger forms of irregular size and shape, including club-shaped and long filamentous forms.

I examined the cases within twelve hours. By that time three of the cases were feeling definitely better. Of the remainder, one had a slight leucopenia which put him outside the possibilities of an acute meningococcus infection. The case in which Gram-negative coccobacilli were found in the cerebrospinal fluid still appeared acutely ill, the temperature being 102·6° F., the pulse 88. There was definite neck stiffness. The knee-jerks were absent. Kernig's sign was present in one leg and suggestive in the other.

There was a total white blood-cell count of 10,000 per cubic millimetre. Differential count: Polynuclears, 70 per cent; lymphocytes, 20 per cent; monocytes, 10 per cent.

A lumbar puncture showed the cerebrospinal fluid to be clear and not under pressure. It had a cell count of 190 cells per cubic millimetre, 95 per cent of which were lymphocytes.

Gram-negative coccobacilli, as above described, were seen in large numbers in stained films from the deposit.

Thus meningococcus meningitis was ruled out, and a diagnosis of acute meningitis due to Friedlander's pneumobacillus was suggested. This appears to be a very rare condition.

The early pneumonic case, who had received an intrathecal injection of anti-meningococcus serum twelve hours previously, appeared acutely ill. Temperature 100·2° F., pulse 88, respirations 20. There were early pneumonic signs in the right lung. Neck stiffness, but no retraction, was present. Kernig's sign was present in both legs. Total white cell count 17,400 cells. Differential count: Polymorphonuclears, 80 per cent; lymphocytes, 15 per cent; monocytes, 4 per cent; basophils, 1 per cent.

A second lumbar puncture was made. The cerebrospinal fluid was faintly turbid and under slight pressure. It showed a cell count of 2,900 cells, of which 90 per cent were polynuclear. No organisms were found in stained smears from the deposit.

A diagnosis of cerebrospinal fever was withheld for the following reasons: The presence of a moderate polynuclear exudate with no visible organisms. The exudate was ascribed to a reaction against foreign protein introduced in the form of anti-serum. The early pneumonic condition, alone, would account for the moderate polymorphonuclear leucocytosis in the blood.

The man developed right basal pneumonia from which he eventually recovered.

Cultures were made from the cerebrospinal fluid in both cases, but they proved sterile.

Cultures from the nasopharynx in all cases produced luxuriant growths of Friedlander's bacillus, in pure culture in the pneumonic case, associated with streptococci and *B. influenzæ* in the case with pneumobacillus meningitis.

(7) *Glandular Fever.*—This is a curious case of an uncommon disease being superimposed on an acute meningococcus pharyngitis.

The patient gave a history of the onset of headache, sore throat, and nausea four days previously. He was admitted to hospital with a temperature of 99·2° F., pulse-rate 72. He complained of headache, stiffness of neck and sore throat. He looked somewhat toxic; his mentality was unaffected. There was acute congestion of the fauces and pharynx. The tongue suggested the "strawberry" tongue of scarlet fever. There was a scarlatinal rash on the back, chest and abdomen. The reflexes were normal; Kernig's sign was absent. A throat swab was taken and a stained smear revealed an infection of Gram-negative diplococci. A nasopharyngeal culture was then taken. Next day the plate showed meningococci in almost pure culture. (When typed it provided an indefinite Type I-III.) A white blood cell-count showed a total count of 14,000 cells per cubic millimetre and a differential count of 16 per cent polymorphonuclears, 73 per cent lymphocytes, and 11 per cent monocytes. The patient was re-examined and a generalized enlargement of the superficial lymphatic glands was discovered. The meningococcus infection of the pharynx gave way before a Vincent's infection of the throat. The man, after being acutely ill for seven days, completely recovered.

This completes the differential diagnosis of cerebrospinal fever from other infections met during the course of the investigation. There are other diseases from which the infection has to be differentiated, but as no cases of the latter were encountered during the year their inclusion is outside the province of this report.

(*To be continued.*)

THE IMPORTANCE OF THE CO-ORDINATION OF MUSCULAR ACTION AROUND THE KNEE-JOINT, IN INJURIES OF THAT STRUCTURE.

By Major R. GELSTON ATKINS, M.C.,
Royal Army Medical Corps.

There is one point of agreement in all articles written on this subject. That is: an original slight injury to the knee-joint is very often the starting-point of an unstable joint.

There should be no need to stress the importance of the chronic knee, as the soldier who has been in hospital on many occasions with an injury to his knee is an all-too-common sight.

If we are to solve the problem of these recurring injuries to the knee, we must first answer the question—Is there something inherent in a slight injury to a knee-joint which leads to the condition of this joint becoming worse and worse? In my opinion the answer is a definite—No. If this is accepted as correct, then the only explanation is that we are not treating these injuries along the right lines.

I believe that enough attention is not paid to slight injuries to this joint, and that when fluid and pain have left a joint it does not follow that the man is fit to resume full duty.

My reasons for this are as follows :—

The integrity of the knee-joint in the fully extended position depends very largely on the normal condition of its ligaments which prevent abnormal movement and practically form the whole strength of the joint. The extended position is maintained by the tonic contraction of the muscles around the joint. When the knee is in any other position, this is maintained solely by the *co-ordinated action* of the muscles governing the joint, the ligaments, with the exception of the crucial ligaments, being lax.

A voluntary or reflex contraction of one group of muscles around a joint is normally accompanied by a reflex co-ordinated relaxation of the opposing muscle group. *It is therefore easy to see that any lack of co-ordination between opposing muscle groups is bound to throw a strain on ligaments which limit joint action.*

After an injury to a joint, reflex atrophy and loss of reflex and voluntary control over the muscles occur (*vide* diagrams). And, furthermore, this being so there must also be a loss of co-ordination between these groups of muscles.

It does not require much imagination to realize that a joint controlled by such muscles as these is very much more likely to be injured than one controlled by normal muscles.

We must therefore devise a more complete treatment than is adopted at present.

Before we discuss the complete treatment of minor injury to the knee-joint there are several other factors to be taken into consideration.

These are : (1) The synovial fluid secreted as the result of an injury is a pathological fluid and as it is not a normal synovial fluid its absorption

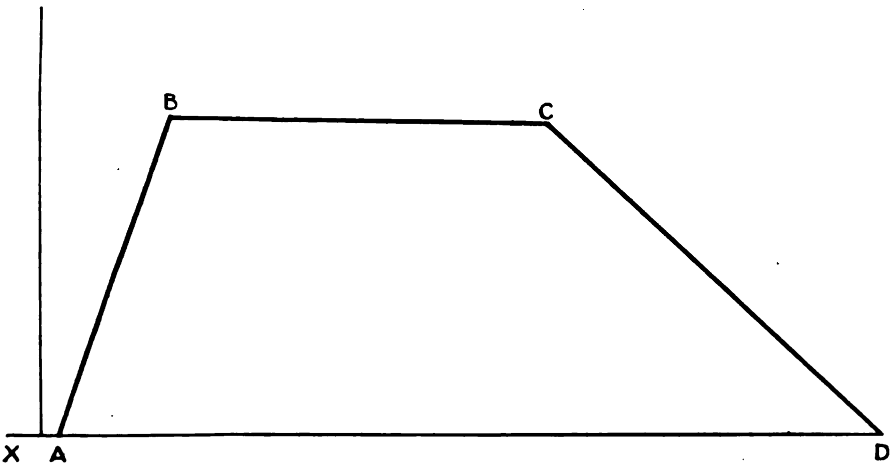

FIG. 1.—This represents a voluntary contraction in a normal vastus internus. The reaction period X—A is short. The contraction rises sharply A—B. It is maintained B—C and it can be relaxed slowly C – D. That is : the muscle is under control.

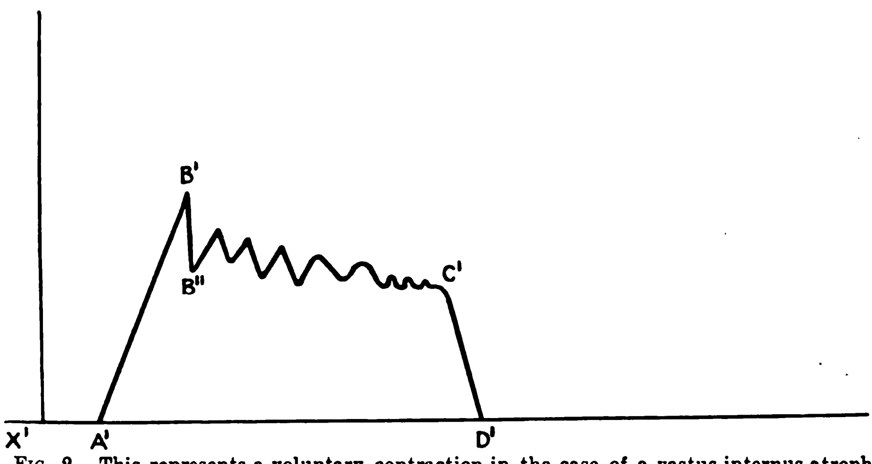

FIG. 2.—This represents a voluntary contraction in the case of a vastus internus atrophied as the result of a strain of the knee-joint in which the accompanying synovitis had subsided. X^1—A^1 the reaction period is longer than normal. The contraction rises slowly and is not as complete as in fig. 1 A—B. There is a sudden drop B^1—B^{11}, when the muscle goes out of control. The remainder of the contraction cannot be evenly sustained, B^{11}—C^1, and finally the contraction ceases abruptly. That is : the muscle is not under control.

does not follow normal physiological principles ; (2) the capsule of the joint is composed of inelastic fibrous tissue ; (3) at the site of any damaged structure there is capillary dilatation and resulting induration ; (4) adhesions, both peri- and intra-articular, are liable to form ; (5) the

lymphatics draining the joint are numerous; (6) the knee-joint is well supplied by nerves, the principal being the nerve to the vastus internus which it supplies before entering the joint.

As a result of the above factors we get marked wasting, loss of tone, loss of control over, and inco-ordination of the muscles governing, the joint.

The picture we have, therefore, is that of a fibrous sac distended by a pathological fluid plus induration in some part of the sac, and several complications, i.e., reflex wasting and inco-ordination of the muscles and the liability to the formation of adhesions. The longer the joint remains distended, the greater is the wasting of the muscles.

The first aim of treatment should therefore be to get rid of the joint distension. This, as the capsule is a fibrous structure, can only take place at the same rate as the capsule retracts. It is therefore necessary to cause absorption of fluid to take place as quickly as possible, as the longer the distension remains, the greater the difficulty in causing the capsule to retract; also the liability to adhesion formation is increased the longer the fluid remains in the joint.

The method I rely on is to produce the greatest possible increase in the *active blood-supply* around the joint. The effusion being pathological will thereby be absorbed, the fibrous capsule will be toned up, induration will be absorbed and finally the muscles will be made as healthy as possible. I particularly mention an increase in the active as opposed to the passive blood-supply, such as is produced by counter-irritants, which I believe to be bad as the resulting congestion tends to soften the fibrous structures about the joint, which is the reverse of what we want to do.

To increase the active blood-supply, the muscles around the joint must be exercised as the arteries of any structure on which rest is enforced diminish in calibre, in which case the blood-supply will be diminished. At the same time we must not impose any further strain on any injured structure. Muscular action must therefore be obtained without producing joint movement.

The patient is therefore instructed to contract his knee extensors with the leg in the extended position, he also uses the muscles on the posterior aspect of the joint against a resistance.

Contrast douching with hot and cold water is also extensively used as this is a very valuable method of stimulating an increase in the active blood-supply. These baths must be used with the following precautions: At the commencement of treatment three or four applications only must be given twice daily; after two days these may be increased to seven or eight applications; the baths should never be used for longer than two minutes at a time. A large area of the thigh and leg should be included. If these precautions are not observed a chronic capillary dilatation takes place; therefore a passive congestion only is produced which is the opposite to what we desire. Massage is employed a great deal as this also aids absorption by the lymphatics.

The order in which treatment is given is :—

(1) Exercises; (2) contrast baths; (3) massage followed by a tight bandage over ample wool. The bandage is only left on for an hour at a time at the commencement of treatment. As the fluid starts to be absorbed and as tissue reaction commences these bandages are left on for a longer period.

In the early stages of treatment when no reaction has taken place there may be small raw areas, where the synovial membrane has been torn; or where there is capillary dilatation. If these areas are situated where normally the synovial membrane is in close approximation, such as in small recesses, &c., it is quite easy by continuous tight bandaging to cause these areas to adhere and so adhesions are formed. But if these areas are allowed to be separated by a layer of synovial fluid until tissue reaction has taken place, we avoid a probable source of adhesions.

A splint may be necessary, especially at night, but usually a firm bandage over ample wool is sufficient restriction for the joint; the fluid usually commences to absorb rapidly, but after a few days the rate of absorption slows down and proceeds more slowly. The joint should look "clean" in ten days in mild cases. In some cases the fluid refuses to absorb from the start. These effusions should be aspirated at once. In fact, I am rather in favour of aspirating all such joint effusions as I am convinced that the longer there is tension of the capsule, the greater the wasting of muscle; but whatever means is adopted, the joint must be emptied as soon as possible. I have also noticed that those knees which I have aspirated because the fluid was slow to absorb, invariably contained blood.

More active exercises than those described are allowed as soon as the tenderness over damaged structures disappears. Cycling on a fixed bicycle is allowed early. As soon as weight-bearing is permitted, steps should be taken to relieve damaged structures from strain. These exercises should always stop short of producing fatigue in the muscles.

As soon as the muscles have recovered sufficiently to produce an active contraction, re-education and co-ordination exercises must be commenced.

I have for some time been using a very simple exercise designed for this purpose. It only requires a length of catapult elastic or one strand from a patent chest-expander, and a home made anklet. The anklet is fitted on, and the elastic attached to it. The other end of the elastic is attached to a fixed point behind the patient, and at such a distance that the elastic is moderately extended. The patient semiflexes the thigh, and while maintaining the relative position of the thigh and body, he extends the knee against the resistance of the elastic, and slowly and evenly allows it to return to the starting position.

This exercise can be reversed by turning the patient to face the fixed point.

Anyone who tries this exercise will be surprised at the amount of control required to carry out such a simple procedure, as with the thigh

flexed and the knee flexed against a resistance both flexors and extensors are in a state of contraction, and as the extensors contract further the flexors have to give way slowly in front of them, and vice versa. This exercise therefore re-educates the co-ordination of opposing muscle groups.

Every knee-joint should be put through its full range of movement as early as possible in the treatment. There is no object in waiting until the case has been admitted to hospital a second time to break down adhesions due to the original injury.

This treatment applies equally to a large number of chronic knees. The cause in many cases of chronic knees being merely the wasted condition of the muscles and lack of co-ordination.

CONCLUSIONS.

A physiological method of treating minor injuries to the knee has been described which gives satisfactory results. Myographs are shown which demonstrate that no man should be allowed to resume full duty until the condition of all the muscles around his knee is found to be satisfactory. This is judged by comparing the two limbs as regards measurements, the rapidity of a contraction and the ease with which a contraction is sustained.

If conscientiously carried out this treatment should lead to a diminution in the number of cases admitted to hospital with recurrent injuries to the knee.

I sincerely hope that this article will be criticized by those who have had more experience than I have. If more articles in the Corps journal were criticized some of us would not be left long in doubt as to the validity of our most cherished beliefs.

NOTES ON THE MANAGEMENT OF VENEREAL DISEASES.

By Major H. G. WINTER, M.C.,
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In all diseases which are liable to chronicity and difficult to cure, new forms of treatment are daily being advocated; this is specially so in the case of venereal disease. It is not the purpose of this article to describe any one new form of treatment, nor is it proposed to discuss the merits of all forms, and no one method is advocated as a panacea in all cases. It is not, in fact, intended to be an exhaustive treatise on the treatment of venereal disease.

We, as military medical officers, are primarily responsible for the health of the serving soldier. There is one great difference in the treatment of military and civil cases in that military cases are invariably treated in hospital, whereas civil cases are treated, as a rule, as out-patients. In the author's experience, civil cases certainly do no worse than military.

The great advantage in having cases in hospital is that they can be observed under various forms of treatment and accurate data compiled; for this reason the author has no hesitation in asserting that the military medical officer is the leading authority in the management of venereal cases. But do we make sufficient use of the material and chances given to us?

The main objection to the treatment of cases in hospital is financial—first the cost of the hospital treatment and secondly the loss in efficiency, training, etc. It is the author's considered opinion that cases, especially of gonorrhœa, are kept in hospital far too long, with detriment both to the State and themselves. This is a condition difficult to alter, as the Army as a whole, especially the lay portion, is so bound down by convention. If cases are kept in hospital only for so long as they have active and acute symptoms and are then discharged to barrack treatment, a great improvement will be seen; these cases do not constitute a grave danger to their comrades, and there is really no necessity for the provision of separate latrine accommodation, etc., for them—except as a sop to public opinion.

The mental aspect of the venereal patient is one of the most important symptoms and one of the most difficult to treat; for this reason, these patients rapidly become hospitalized. It must be remembered that, apart from local disease, they are physically fit men who chafe against the restrictions put upon them and feel the stigma of disgrace which still, in spite of more enlightened present-day opinion, unfortunately exists.

The above remarks chiefly refer to cases of gonorrhœa. Syphilis cases are kept in hospital until all sores have healed, the rash has faded, etc.,

and they have had three weeks' arsenic treatment. This cannot be altered. Soft sore cases must be kept until all sores have healed.

By a judicious combination of various methods of treatment it has been found possible to hasten considerably cure and consequently to lessen the cost to the State. As proof of this the following figures, taken from the records of the British Military Hospital, Barrackpore, Bengal, India, may be quoted :—

GONORRHŒA CASES.

Year	Total number of admissions		Average number of days in hospital per patient	
	Fresh cases	Relapses	Fresh cases	Relapses
1929	116	9	92·70	72·30
1930	70	15	86·52	65·00
1931	76	11	56·12	30·71

Some of the forms of treatment described below are old and, possibly nowadays, out of date, but in certain cases all have their uses. It is thought better to describe these methods under general headings.

GONORRHŒA.

Bed.—It is the accepted principle that a fresh case when admitted to hospital should immediately be put to bed on a milk diet and given no irrigations ; he is then automatically marked " up " on the tenth day. The civil case has to go on working from the first day onwards ! A certain amount of rest is essential in most cases, but each must be judged on its merits : some only require one or two days. Of course, if acute complications supervene bed is indicated.

Diet.—Milk diet is indicated at first, but it should only be continued for a minimum period as it tends to lower the patient's body resistance—the amount of toxæmia in a case of gonorrhœa is not fully realized. Most cases can be put on an ordinary diet at the end of a week. The diet should be as rich as possible in vitamins. Plenty of fluid is necessary and is best given in the form of barley water—at least two and a half pints per patient per diem. That made with Robertson's patent barley is best and, moreover, is very economical in fuel used ; it will therefore be found cheapest in the long run.

Exercise.—Soldiers are used to taking a considerable amount of exercise and suddenly to curtail this by incarceration in hospital is detrimental both mentally and physically, with consequent reduction in body resistance. Even in acute cases exercise is essential. Walks, graduated P.T. for fifteen to twenty minutes in the early morning, will be found beneficial and, contrary to the usual belief, complications such as epididymitis do not occur if the P.T. is not overdone. Every patient should, however, be made to wear a suspensory bandage, either in the form of a " Jock Strap " or of the pattern illustrated in Colonel Harrison's book ;[1] the latter can easily be made by the hospital tailor.

[1] " Diagnosis and Treatment of Venereal Diseases in General Practice," third edition, Oxford University Press, London.

Mental Treatment.—This depends largely on the temperament of the medical officer treating the case and the mentality of the patient. As previously stated, apart from the local disease and concomitant toxæmia, the patient is a fit man and if he is well fed, has plenty of mild exercise and recreations—i.e., suitable books, games, etc.—he will do far better.

It is the highly-strung, imaginative individual who, physically reduced by insufficient diet and exercise, has had it constantly rubbed into him that he is a criminal and outcast and has been given plenty of time to brood over his sad state, that becomes chronic and extremely difficult to cure. This does not mean that discipline in the venereal ward must be relaxed; it must, on the other hand, be very strictly enforced. A cheerful, sympathetic and optimistic attitude on the part of the medical officer and attendants will often work wonders in a backward and chronic case.

Period in Hospital, etc.—As soon as the acute symptoms have subsided and when smears cease regularly to show gonococci, the patient may be discharged from hospital to barrack treatment; the fact that smears occasionally show gonococci does not matter.

The best method is to arrange with the Officer Commanding a unit in the station to form an Attached Section to which all such cases, to whatever unit they belong, may be sent. When in the Attached Section they are under the command of a N.C.O. and carry out all duties and training, but are barred from the wet canteen and are not allowed "on pass." They are marched to the hospital every day for treatment and are seen by the medical officer once a week, or oftener if required, for special treatment. When they are apparently free from disease they are discharged from the Attached Section and return to their units for full duty, but are kept under surveillance for a further three months.

Should a case, whilst either in the Attached Section or under surveillance, develop symptoms of complications, he is re-admitted to hospital as a relapse.

The mental effect of this form of treatment on the patient is considerable.

A word here would not be out of place regarding the question of "test of cure." In the author's opinion there is not, with the possible exception of the endotoxin test described in a previous article,[1] any reliable test of cure and he does not use one, but depends chiefly on clinical and bacteriological findings. Experience has shown that if the test used is negative there is no certainty in most cases that a cure has been effected, but if the patient breaks down under test the resultant attack is inclined to be very chronic and resistant to treatment. Of course, in the case of contemplated marriage some such test must be done in addition to clinical and bacteriological examinations.

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[1] "Recent Advances in the Treatment of Gonorrhœa." By Majors White and Winter, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, October, 1929, liii, 250.

Medicinal Treatment.—From the commencement of the disease alkalis, together with sedatives such as hyoscyamus and diuretics such as buchu, are given. The amount of alkali is regulated by periodical examination of the urine—a constant pH value of 7·2 is aimed at. Alkaline sodium phosphate is undoubtedly the best alkali for this purpose, but when it cannot be obtained sodium bicarbonate and sodium citrate may be used. In mild or threatened cases of posterior urethritis tincture of belladonna is added.

In more severe cases of posterior urethritis and in vasitis, vesiculitis or acute prostatitis, etc., the alkali is temporarily discontinued and sandal-wood oil given as a sedative. This drug has no curative value, but it does have a sedative action on an acutely inflamed and painful urethral mucous membrane. It is stated to cause digestive disturbance, but it has been found that this is less likely to occur if administered as Nesbit's specific (Extra Pharmacopœia) which is:—

℞	Ol. santal	.. .. ..	12½ dr.
	Ol. cassia	.. .. ..	1¼ „
	Ol. pimento	.. .. ..	15 minims
	Alcohol, 90 per cent	.. ..	3½ oz.

½ dr. to 1 dr. in milk, t.d.s.p.c.

In acute cases of posterior urethritis, etc., suppositories also are used. Either atropine grain $\frac{1}{75}$ and belladonna grain ¼, atropine grain $\frac{1}{75}$ and morphia grain ⅙, atropine grain $\frac{1}{75}$ and acetanilide grains 4 or atropine grain $\frac{1}{75}$ and ichthyol grains 5, or other suitable combinations according to the type of case under treatment. In this connection it is interesting to note that a suppository of atropine and belladonna combined is more effective than either separately, presumably because plain atropine does not contain the other alkaloids in belladonna and belladonna alone does not contain sufficient atropine.

In highly neurotic cases and those with chordee, etc., sedatives are required; bromides are usually used, but are depressant, and it has been found that other drugs, such as camphor monobromate, are preferable. A very excellent prescription is:—

℞	Luminal	.. ..	12 gr.
	Camph. monobrom. lupulin..	āā	2½ dr.
	Plv. et Succ. Liq. āā qs. ft. pil.	..	100

(2 pills = luminal ¼ gr.)

1 to 2 pills t.d.s.

Later in treatment it is advisable to discontinue the alkali and to give some form of tonic; syr. of glycerophosphates combined with syr. ferri iodi. has been proved of value.

In spite of careful treatment some patients do not do well and become pale and listless; this usually affects certain types, especially those with auburn hair and clear complexions. In most cases this is apparently due to a calcium deficiency caused primarily by an inefficiency of the parathyroids

and aggravated by the large amount of alkali taken. The administration of calcium in such cases is indicated and it can be given either as calcium lactate or kalzana, or better still as a calcium and parathyroid preparation such as calcinol and endocrene.

Vaccines.—The gonococcal exotoxin of Dimond, prepared in the Central Laboratory at the Royal Herbert Hospital, Woolwich, is still used exclusively with excellent results, and the author sees no reason for making any change. Various types of vaccines, including the courses issued from Kasauli and also German and other preparations, have been tried but discarded in favour of exotoxin.

The routine is one cubic centimetre ($7{,}000 \times 10^6$ cocci) intradermal into the inner side of the thighs and the dorsum of the penis for four to five weeks at weekly intervals. No advantage has been noted by giving two cubic centimetres as originally advocated. Recently, slightly more local reaction has been noted, especially with batches II and III; there is very little reaction with batches I and V; the author has not received any supply of batch IV.

The exotoxin keeps very well in the tropics, but for the best results it must be kept in the ice-chest. Stocks have been kept at room temperature in the hot weather for six months with only a slightly noticeable decrease in antigenic value but, what is more important, with a distinct increase in toxicity, as evidenced by increased local and general reaction.

Other Forms of General Treatment.—Certain proprietary drugs intended for oral, subcutaneous, and intramuscular administration have been used; amongst them manganese butyrate and collosol manganese are satisfactory, especially in cases with secondary infection; of the two, manganese butyrate gives better results. S.U.M. 36 was tried, but results were uniformly disappointing.

In cases of prostatitis and epididymitis protein shock treatment with sterile fat-free milk has been given intramuscularly and intradermally with excellent results. At first aolan was used, but later a similar and cheaper preparation manufactured by the Bengal Chemical and Pharmaceutical Company, sold under the name of lactumin, was tried. It was found that with this better results were obtained, possibly because this preparation is made from buffalo and not cow milk.

Of other drugs neotropin and pyridium have given disappointing results.

Irrigation.—Potassium permanganate still remains our sheet anchor, but the author is of opinion that it is almost invariably used far too strong. It is now generally accepted that sterilization of the urethra with an antiseptic is not feasible with the drugs at our disposal and mechanical flushing with a non-irritant fluid strong enough to kill the gonococci in the urethra is to be aimed at. Potassium permanganate 1/20,000 is quite strong enough for the purpose, at any rate in the early stages. Irrigations are given right from the commencement and are always posterior, on the assumption that an anterior irrigation only pushes the discharge back into

the bulb, where it remains a constant source of danger to the posterior urethra, whereas a thorough flushing out of the whole urethra and bladder with large quantities of fluid cleanses the whole tract; as proof of this may be cited the patient who is unable, usually for nervous reasons, to irrigate properly and cannot therefore take more than an anterior irrigation, and who almost invariably develops an acute posterior urethritis.

Gonococcal pus is extremely irritating on account of the large amount of highly concentrated endotoxin it contains—due to autolysis of dead and dying gonococci. Irrigation is therefore an essential form of treatment, cannot be dispensed with and should be commenced at the earliest possible moment. It is unfortunate that pus must collect during the night and various preparations such as soluble bougies and drugs suspended in a gelatine base have from time to time been devised in an endeavour to continue treatment at night, but none of these has proved of any outstanding worth, chiefly, it would appear, because the cause is not removed, e.g., accumulation of endotoxin in contact with inflamed tissue. A possible line of research immediately suggests itself in the direction of an antitoxic serum.

In the more chronic cases the strength of potassium permanganate is sometimes, with advantage, increased to 1/10,000 or 1/8,000. In others which do not appear to be doing well it may be made up in normal saline, or in normal saline with 1 per cent soda bicarb. The use of normal saline alone, as recommended by Major L. B. Clarke, is beneficial in many cases.

In some cases a change over to one of the silver preparations often pays, but these also should be weak—silver nitrate 1/8,000, protargol 10 per cent (protargol granulate is excellent), argyrol 5 per cent, etc.

In some chronic cases it is advantageous to stop irrigations altogether for a time, even if gonococci are still regularly present in the smears.

"Morning gleet" is a bugbear to all who are called upon to treat gonorrhœa. It has a variety of causes; it may be due to active but chronic disease, in which case gonococci appear periodically in the discharge, or acute exacerbations may occur; it may be due to continuance of the lesions—usually in the prostate or vesicles—by intercurrent secondary organisms after the gonococci have disappeared; again it may be due to discharge of mucus from the damaged epithelium; lastly it may even be a simple so-called spermatorrhœa. The treatment of the first is the same as for chronic gonorrhœa; as regards the second it may be stated that if secondary infection occurs in any number of cases the orderly in charge of the irrigation room is to blame, in that proper sterilization of nozzles, cans, etc., is not being attended to, and irrigations are not being properly carried out as regards cleansing the glans penis. Secondary organisms are usually only of very low virulence, but may become more pathogenic. As a rule they commence as saprophytes living on the gonococcal pus, but it would appear that they are largely the cause of chronic arthritis occurring in old cases with prostatitis, in the same manner as a root abscess in a tooth.

Many organisms have been found but one of the commonest is a diphtheroid, *Bacillus coryzæ segmentosus.*

Irrigation with mercury oxycyanide 1/8,000 twice a day for two days is indicated in these cases; it must not be continued for more than two days, as it tends to cause a chemical irritation.

In the third type of case, " no treatment" is the best course, to allow the body to repair the damage and adjust itself. In severe cases, irrigation with alum or zinc sulphate for a few days at the commencement may hurry things on. The last type usually occurs in neurotic individuals, some of whom may never have had gonorrhœa; it is due to secretions from Cowper's, Littré's and Tyson's glands and also possibly from the prostate and vesicles, resulting from constant " milking " to see if there is a discharge. Cases in which this condition occurs are usually confirmed masturbators, and psychotherapy is the only treatment.

Instrumentation, etc.—Up till quite recently it was taught that the passing of bougies, preferably rather bigger than the urethra could comfortably stand, was the best treatment for gonorrhœa, and some practitioners still appear to think that they are not doing their best by the patient unless they pass sounds, massage the prostate, etc., with the utmost regularity. The urethral mucous membrane is one of the most, if not the most, sensitive tissues in the body, and no mechanical interference should be advocated except where absolutely necessary. Some years ago stricture was a common complaint, to-day it is comparatively rare. One of the reasons for this is undoubtedly the less heroic methods used in treating the disease.

No instrumental interference should be attempted until the acute symptoms have subsided; then, if the bore of the urethra will allow, a urethroscope should be passed; if there are any follicles, straight sounds will be required for two or three weeks at weekly intervals and the follicles massaged—curved sounds are rarely necessary. If no follicles are seen and the urethra looks moderately healthy, no sounds need be used.

In chronic cases, with hard encysted follicle, it has been found that cauterizing the follicle with silver nitrate by means of the operating urethroscope, followed by massage on a sound a week later, usually has an excellent result. This operation, however, requires very great care.

The author very rarely has recourse to Kholmann's dilator.

As in the case of sounds, prostatic massage is very much overdone. If there are no symptoms, and if the vesicles, prostate, etc., feel normal at the first examination, there is no need to carry out prostatic massage as a routine, and harm may be done by doing so. Massage should only be carried out for so long as symptoms and signs warrant it.

The author was once called to see a high official who had had gonorrhœa and who had been treated for over eighteen months by various doctors. He complained of a constant morning gleet. On going into the history, it was found that for about nine months he had been in the habit of massaging

his own prostate daily! and had been irrigating twice a day since the commencement. By knocking off all treatment, and by persuading him that in massaging his prostate he was doing harm, the patient was rapidly cured. This does not infer that in certain chronic cases, especially those with a secondary infection, prostatic massage may not be required regularly for considerable periods.

One complication which is fairly common and, if slight, is very liable to be overlooked, is tysonitis. This condition may considerably prolong the disease, and every case should be examined periodically. If tysonitis occurs, a good treatment is cauterization with silver nitrate fused on to the end of the stilette of a hypodermic syringe needle.

Periurethral abscess is not uncommon. In this condition it has been found that if, as soon as there is pus formation, the abscess is aspirated and washed out with ten per cent protargol, it is more likely to subside without fistula formation through the skin surface, and that pain is immediately relieved.

Acute epididymitis is a most unpleasant complication for the patient, but it has been found that, although painful at the time, aspiration with a wide bore needle fitted to a hypodermic syringe—and although nothing may be withdrawn—results in immediate relief and rapid recovery.

Diathermy.—From a study of the results obtained by various workers it would appear that the optimum temperature for the growth of the gonococcus is a degree or so below normal, and that growth is inhibited at a temperature of over 101° F. Opinions differ as to the lethal temperature—it may be 102° to 115° F. or more—but from the fact that cases have occurred in which gonorrhœa has been cured by attacks of pyrexia due to malaria, etc., and also from the beneficial results obtained from protein shock therapy, it would appear that *in vivo* it is not very high.

Numbers of experimenters have studied the temperature of the male urethra and, with a normal body temperature, the average has been found to be between 93° and 94° F. and, even when infected with chronic gonorrhœa, it does not exceed 95° F. Moreover, in patients with an axillary temperature of 104°, the urethral temperature was 99° F.[1] It seems reasonable, therefore, to suppose that application of heat should be one of our most promising lines of treatment, especially as heat sufficient to inhibit, and even kill the gonococcus, is not sufficient to injure the living tissues. In the treatment of acute urethritis in the male many attempts have been made in this direction, one of the earliest of which was the double-channelled water-heated bougie devised by Mr. Frank Kidd. None, however, has been found uniformly satisfactory and some are even dangerous.

Diathermy would, at first sight, appear to be an ideal method, but here

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[1] "Treatment of Gonococcal Infection by Diathermy"—Cumberbatch and Robinson. London: Heinemann.

again it has not come up to expectations, mainly due to the difficulty experienced in placing the electrodes so as to obtain a uniform heating of the whole urethra. The best method yet devised is that of Cumberbatch and Robinson, in which the penis is doubled back to lie in contact with the perineum; one electrode is applied along the dorsum of the penis and the other is placed in the rectum. It is in the treatment of complications of gonorrhœa and in the treatment of the disease in the female that diathermy is of value, and it should be a part of the routine treatment in all venereal clinics.

In all cases the focal centre of infection should be treated in addition to the local—i.e., in arthritis the prostate and vesicles are treated as well as the affected joint. Excellent results, including rapid relief of pain and swelling, can be obtained by diathermy of the acutely infected epididymis. In this case the prostate, prostatic urethra, vesicles, etc., are dealt with at the same time as the testicle by placing one electrode in the rectum and the other on the testicle.

In view of the insensitiveness to heat of the cervix, etc.—which can stand a temperature of 120° F. without damage or pain—great improvement can be obtained by the treatment of the cervix, pelvic organs, etc., with diathermy.

It is beyond the scope of this article to describe in detail, diathermy technique nor indeed is it necessary. Those who are interested and who have a machine available will possess a textbook on the subject—those by Cumberbatch, and Cumberbatch and Robinson are to be recommended.

SYPHILIS.

Apart from slight modifications in the process of manufacture of the usual drugs used, resulting in improvement in these products, there has been little advance in the technique of the treatment of syphilis in recent years, and such treatment has become practically standardized. In the majority of cases, routine rule-of-thumb methods are all that is required to ensure cure. Certain conditions, however, require special mention.

Much has been written about and a number of courses of treatment devised for so-called "Wassermann fast" syphilis. Management of such cases is a long, tedious and costly proceeding. That continuation of treatment is necessary is a matter for dispute, but the author is of opinion that every effort should be made to reduce the Wassermann reaction to negative.

A method of treatment which has been found efficacious in these cases is, after the completion of the usual long course, to commence a series of short courses of five weekly injections with three monthly intervals between; at the end of each course the drugs are changed—i.e., NAB in place of sulphostab, and mercury in place of bismuth, etc.—and, further, potassium iodide is continued by mouth during the course. Even better

results have been obtained by giving whole blood injections (i.e., autohæmotherapy) weekly at all rest intervals.

A word here will not be out of place regarding the relation of albuminuria to the treatment of syphilis. Most medical officers appear to regard the appearance of albuminuria as an absolute contra-indication to the continuance of treatment and are loth to recommence in fear of causing more serious complications. The procedure in cases with intercurrent albuminuria is entirely dependent on the diagnosis. That albuminuria is not a contra-indication but rather an indication for caution is clearly set forth in most textbooks, especially by Harrison and David Lees. Cases of this nature may be divided into three categories :—

(1) Those with renal disease showing albuminuria before infection.

(2) Those with apparently normal kidneys who develop albuminuria after infection.

(3) Those with normal kidneys who develop albuminuria after treatment.

In every case the condition of the kidneys should be carefully investigated—heart and optic fundi examined, blood-pressure taken, urea concentration and renal efficiency tests done.

Cases coming under category (1) have obviously damaged kidneys at the outset and these are more likely to become infected with syphilis, which always attacks an already damaged organ. If the previous history be carefully taken in cases coming under (2) it will usually be found that the kidneys have been, if not actually damaged, certainly lowered in resistance by previous disease.

The longer syphilis of the kidney is left untreated, the greater the permanent damage resulting in a worse prognosis. Syphilitic infection may occur either in the secondary or tertiary stages and may be either parenchymatous or interstitial. A diagnostic point is that both are characterized by an enormous quantity of albumin in the urine ; casts may or may not be present and the symptoms are not nearly so severe as the quantity of albumin would appear to suggest. Treatment of such cases results in a rapid disappearance of the albumin, either entirely or up to a certain point which is dependent on the amount of permanent damage sustained ; it, however, immediately re-appears if treatment is stopped prematurely. It may be laid down that nephritis in a syphilitic patient is not necessarily syphilitic in the first place, but will certainly become so if the syphilis is left untreated.

Remedies used in the treatment of syphilis are admittedly toxic to the human organism, and various symptoms occur in susceptible individuals ; such symptoms vary with different patients. It is reasonable to suppose that the toxin will first attack already injured organs—e.g., a patient with a liver damaged by alcohol, etc., may get jaundice, another sensitized by seborrhœa may get dermatitis—it is therefore not unreasonable to suppose that a patient who develops albuminuria during treatment has, at any

rate, a weak kidney. This is, then, no contra-indication for treatment, but only requires care in administration. Treatment of syphilis cases in which albuminuria occurs should be confined to the administration of organic arsenic preparations. Bismuth is liable to cause damage to the kidneys in any case and should not be given. In all cases reduced doses should be given at first but may be increased with advantage, especially in cases coming under categories (1) and (2).

Soft Chancre.

Treatment of this condition is still very unsatisfactory and no important advance has been made in recent years. The author has tried many remedies, oral, intravenous, intramuscular, local, etc., but none has shown promise of universal success; in fact, in a large number of cases, the greatest improvement appears to result from the "cleaning up" given with normal saline for two or three days prior to and during the routine dark ground examinations.

No general treatment appears to exercise any great effect; sodium antimony tartrate, urea stibamin, neostibosan, aolan, whole blood injections and a host of other remedies have been given a trial. Improvement has been noted on certain cases and hopes raised only to be dissipated by trial on other cases.

One line of treatment seems to give more uniform results; this is to wash the sores two or three times daily in eusol and to dress with a wet dressing of urotropine, one drachm to one ounce. The main object of treatment is to keep the parts as surgically clean as possible and prevent, at all costs, the accumulation of discharges.

In uncircumcised cases, free drainage is difficult unless operative interference is resorted to. Circumcision is contra-indicated as the whole wound is liable to infection and a serious condition may result. It is best in all such cases to slit up the prepuce and remove a wide "V" shaped piece from the dorsum. The remainder of the foreskin shrinks after healing, and it is surprising how seldom a further cosmetic operation is required. This operation should be done in every case with a long foreskin. A general anæsthetic should always be given and no attempt made to do it under local anæsthesia.

In some cases, especially the rapidly eroding, foul serpiginous variety, two or three applications of camphphenol are excellent.

Some sores are liable to become chronic and no improvement is noted for some time. In these cases cauterization either with copper sulphate, silver nitrate or the actual cautery is often effective. In large sores with exuberant granulations which have come to a standstill, especially those resulting from the opening of buboes, application of scarlet red ointment for twenty-four hours, followed by a mild ointment such as acid boric, often promotes rapid healing.

As regards buboes, local applications such as antiphlogistine, gentle massage with iodex ointment, etc., are sometimes helpful in the early stages. When broken down, free incision and drainage is the only course to adopt. It will be found, however, that if a day or two before incision the abscess cavity is aspirated and washed out with iodine, 1 in 12 in water, and after incision it is scraped with a spoon and swabbed with camphphenol, healing tends to be less painful and more rapid.

It is hardly necessary to state that, as in the case of most other diseases, nursing and the general management of venereal cases is of paramount importance; an efficient Special Treatment Orderly is invaluable.

AN ACCOUNT OF MOSQUITO-PROOFING CARRIED OUT BY THE ROYAL AIR FORCE IN INDIA.[1]

By Group Captain A. W. IREDELL, L.R.C.P., M.R.C.S., R.A.F.

THOUGH it is unnecessary to convince the medical profession of the value of mosquito-proofing against malaria, I know how sceptical laymen are on this point—financial experts particularly so—and I feel convinced that every piece of evidence will be of value to those who may have to give non-medical authorities reasons why mosquito-proofing would be of practical value in a malarial district. I will confine myself to an account of what has been done in this way by the Royal Air Force in India, with the special reasons for it, and then give the statistical results.

After the late war, the portion of the R.A.F. serving under the Government of India in a similar manner to the British Troops in India very soon suffered a heavy incidence of sickness due to malaria—the more so as several of the places where R.A.F. units were serving were amongst the stations with the highest malarial incidence. This involved a serious loss of man-hours—a matter of grave import to the R.A.F., which is mainly composed of skilled tradesmen.

The R.A.F. authorities in India set to work to obtain permission to mosquito-proof their stations, being fired by the results of the Army's work in proofing barracks in Lahore Cantonment, as described in a paper read by Lieut.-Col. J. B. Hanafin, I.M.S., before the Far Eastern Association of Tropical Medicine at Calcutta in 1928.[2] As this paper may not have come to your notice, a short digest of it may be of interest.

In Lahore Cantonment the barracks of a British infantry battalion were mosquito-proofed, while other barracks near-by, which housed British troops, remained unproofed. A statistical table showed the case-incidence of malaria amongst these troops quartered in the two sets of barracks for five consecutive years. For the first three years neither set was proofed, and for the last two years one was proofed. The table showed that the case-incidences of malaria in troops occupying the first set of barracks were 850, 483 and 569 per 1,000 for the years in which the barracks were unproofed. These figures fell to 182 and 46 per 1,000 for the two years in which they were proofed. The corresponding figures for the unproofed barracks for the first three years were 594, 307 and 470 per 1,000, that is, better figures than those for the same years for the men quartered in the first set of barracks. In the last two years, however, the figures relating to the second barracks were very definitely worse than those of the proofed set, being 672 and 266, as compared to 182 and 46.

To my mind, this was conclusive evidence of the efficacy of mosquito-proofing in reducing the incidence of malaria.

Sanction of the Government of India was eventually obtained for an R.A.F. station to be mosquito-proofed during the current financial year, and for one to be

[1] A paper read before the United Services Section of the Royal Society of Medicine, October 10, 1932, and reprinted by kind permission.

[2] *Journ. Roy. Army Med. Corps*, 1928, li, 127.

similarly protected in each subsequent year until R.A.F. stations in India were completed in this respect.

The first station selected was the Aircraft Depôt at Drigh Road, about seven miles from Karachi. This was the largest R.A.F. station in India, with about 730 British personnel, excluding families and civilians. Another reason for its selection was that a number of airmen are drafted direct from Iraq to India to complete their tour of overseas service; the majority of these are posted to Drigh road, and some of them have contracted malaria in the former country, and so are potential sources of the spread of the disease. The buildings proofed were mainly those occupied by airmen (not officers), particularly those in which they spend some or all of the hours of darkness, i.e., barracks, canteens, sick quarters and buildings in which work is carried on throughout the twenty-four hours, e.g., the wireless station.

Construction.—The buildings concerned were surrounded by verandahs. The archways on the outer side of all verandahs were accurately fitted with strong wooden frameworks and the intervening spaces subdivided into squares by stout wooden battens. Over this framework was fitted and secured fine wire gauze of a mesh of 18 per sq. in., the gauge of the wire being 28 b.w.g. The composition of the wire was 90% of copper, the remainder being zinc, and according to the specification it was to contain no iron if possible, but in any case this was not to exceed ½%. The wire gauze was reinforced for the lower 4 or 5 ft. with ordinary 1 in. wire netting or other suitable material, to prevent it from being damaged. Each entrance consisted of a porch about 10 ft. long totally enclosed by wire gauze. At each end were double swing doors opening outwards, each door being faced along the opposing edge with leather, and having a strong spring which closed it automatically. The length of the porch prevented anyone from opening the doors at each end at the same time. All drains, chimneys, ventilators, and other openings, were proofed. Mosquitoes were thus kept out of the buildings. Good materials were used and the total cost was Rs. 111,000 (£8,300).

Preservation.—Arrangements were made for the early discovery of rents or tears in the gauze, and as soon as any were reported, patches of similar gauze were sewn over them with fine copper wire. Springs on the doors were replaced directly they became defective, and every effort was made to keep the defences against mosquitoes intact. As the station is in a sandy location where there is nearly always a sea breeze, the gauze mesh became more or less filled with fine sand in the course of time. Experience showed that gentle hosing with water cleaned the gauze more satisfactorily and quickly than scrubbing with hard brushes—and without injuring it or causing corrosion.

The major part of the mosquito-proofing of this station was completed in 1929 before the malaria season; and the whole of the work was completed by February, 1930.

The next station to be mosquito-proofed was Kohat—a two-squadron station with an average strength of about 250 British personnel, excluding families and civilians. A smaller figure (188) is shown in the tables as it was a single-squadron station during part of the period of my report. This station was selected on account of the high incidence of malaria there. Just outside the station, and separated from it only by a railway siding and a road, is a prolific mosquito-breeding area which is

outside the cantonment boundary. All efforts to exercise any sanitary control over this area failed. Anti-mosquito measures had been carried out on the irrigation ditches in 1928, and to a lesser extent in 1929, but as they involved monetary compensation to the landowner, they had to be discontinued.

The proofing of the same types of buildings at Kohat was carried out as at Karachi, and was completed in May, 1930, at a cost of Rs. 50,000 (£3,700).

Unfortunately, after the completion of the proofing of this station, the necessity for economy in India became very urgent, and the projected programme for proofing other stations had to be abandoned.

As to the results of mosquito-proofing these two stations, I have compiled two tables from data obtained from the Official Reports on the Health of the R.A.F., except for 1931, the figures for which have been obtained from India direct, as the official report has not yet been published.

Table A deals with the case incidence of primary malaria. The R.A.F. officia reports give figures both for primary malaria and for total cases of the disease. Since this paper deals with the prevention of malaria by mosquito-proofing, I prefer to take the figures for primary malaria as the standard of reference. In case, however, it may be considered that errors of diagnosis may have led to some cases of primary malaria being shown as recurrent malaria, Table B, which gives figures in respect of all cases of malaria, has been drawn up. A comparison shows that they demonstrate the same results in much the same degree, especially if allowance be made for the fact that as primary cases increase or decrease, so in succeeding years recurrent ones may similarly be expected to become more or less.

TABLE A.—MALARIA (PRIMARY) AT R.A.F. STATIONS, INDIA.

Station	Average strength	Case Incidence per 1,000						
		1925	1926	1927	1928	1929	1930	1931
Karachi ...	729	99	142	183	44	**32**	**20**	**10**
Kohat ...	188	149	378	183	150	280	**167**	**57**
Ambala ...	146	119	124	104	37	30	26	91
Lahore ...	146	118	261	187	21	150	90	87
Peshawar ...	164	85	214	126	39	180	50	6
Quetta ...	231	17	233	40	46	85	46	125
Risalpur ...	247	61	139	85	15	189	57	39

TABLE B.—MALARIA (ALL CASES) AT R.A.F. STATIONS, INDIA.

Karachi ...	729	218	263	376	191	**73**	**49**	**27**
Kohat ...	188	421	705	488	378	547	**374**	**151**
Ambala ...	146	318	311	243	52	37	43	111
Lahore ...	146	562	577	347	106	235	166	120
Peshawar ...	164	193	307	311	126	333	107	31
Quetta ...	231	103	356	82	56	136	98	230
Risalpur ...	247	265	275	204	82	227	188	93

The tables show in the first column the locations of the R.A.F. stations in India, excluding the Hill Depôt and Headquarters. The Hill Depôt is occupied for about six months of the year only, and is in a non-malarious district, whilst the Headquarters strength is only about thirty persons, and is stationed at Simla or Delhi according to the season. The second column shows the average strengths of

the stations during the seven years concerned. These are included merely to give an idea of the numbers involved. It demonstrates the smallness of the strengths at most of the stations, which tends to make greater yearly variations in case incidence than when larger numbers are being dealt with.

The remaining seven columns show case incidences in round figures per thousand for the seven years 1925 to 1931. The figures for 1928 were the lowest recorded at all stations since the R.A.F. first served in India. In that year the rainfall in Northern India was comparatively small, which was almost certainly the main factor in reducing the incidence of primary malaria. It would appear, therefore, fair to take these figures as a standard with which to compare the figures of the subsequent years.

Looking at the figures for Karachi in Table A, the three "proofed" years show a definite and progressive improvement on 1928, namely, 32, 20 and 10 as against 44, and a very marked improvement on the figures for the three previous years of 99, 142 and 183.

At Kohat the year 1929 showed an increase on 1928, namely, from 150 to 280, and a similar increase occurred at all the other stations, excepting Ambala. In 1930, when the proofing first functioned at Kohat, the figure improved from that of the preceding year to 167, but this was slightly higher than that of 1928, when it was 150. This increase is almost negligible when such small numbers are concerned, and yearly variations of climatic conditions are involved. In 1931 the case incidence fell to 57, a figure well below that of 1928, namely, 150.

On comparing the figures for the remaining five stations, it will be seen that the case incidences for 1929, 1930 and 1931 fell below those of 1928 only in three cases out of 15.

With regard to Ambala, the figure of 37 in 1928 was beaten by 30 and 26 in 1929 and 1930, comparatively small differences, but it rose to 91 in 1931. As an explanation of this, the health report for 1930 stated: "The progressive improvement of the figures for Ambala is attributable to the fact that although mosquitoes are very numerous there, it has been found that anopheles are becoming scarcer year by year." The report for 1931 remarked: "The increase in malaria on this station may be attributed to the long and heavy monsoon, which occurred rather later than usual." From this it must be inferred that with the increase of collections of water due to the heavy monsoon, anopheline mosquitoes either invaded the neighbourhood, which is most unlikely, or that they multiplied very abundantly from the few that had been present in 1930.

The third figure, which beat the 1928 record, occurred in 1931 at Peshawar. This was 6 (representing one case), as compared with 39 recorded in 1928, and 180 and 50 in 1929 and 1930 respectively. The health report for 1931 states in respect of this station; "There was hardly any rain in the summer of 1931, and mosquitoes were not plentiful."

To sum up: Two stations showed, on the whole, improved figures on their previous records of 1928 after mosquito-proofing had been completed, whereas for the same years the other five unproofed stations showed in the main higher case incidences. Other factors remained substantially the same at the stations; consequently the improved figures for Karachi and Kohat as opposed to the retrogressive ones for the other stations must, in my opinion, be ascribed to the mosquito-proofing.

It may be argued that the chief factor in the incidence of malaria is the rainfall, which varies in different localities. To this I reply that in considering figures for various stations over a number of years, the rainfall will vary occasionally, as at Ambala and Peshawar in 1931, the one abnormally heavy and the other abnormally light, but that in the majority of cases the variation of rainfall will be in proportion to the type of the monsoon, whether it be a heavy or a light one.

Finally, in addition to the diminution of malaria resulting therefrom, mosquito-proofing has at least two other advantages that have a direct effect in the prevention of disease.

(1) Mosquito-nets are rendered unnecessary. The discomfort of a narrow bed under a mosquito-net in the climatic conditions that obtain during the hot weather at Indian stations on the plains has to be experienced to be fully realized. After having slept inside mosquito-proofing, the men were most emphatically and unanimously in favour of it, as opposed to mosquito-nets. They were able to sleep better, sleep was more easily obtained, it lasted longer and they felt more refreshed than after sleeping under mosquito-curtains.

This must have a beneficial effect on the health of the troops and must lessen the incidence of those slight cases of mental irritability which frequently occur in the plains during the hot weather and which in some cases lead to neuroses with consequent admissions to hospital and possible invalidings.

(2) Flying pests other than anopheline mosquitoes are excluded. Flies are a nuisance, and when men take a siesta their presence is an annoyance and interferes with rest. Culicine and other species of mosquitoes also, by their biting, are a source of trouble during the hot weather, and their exclusion tends to decrease the incidence of septic sores, etc., which so often owe their origin to insect bites.

These advantages may be of secondary importance, though they are not so considered by the majority of the men who have experienced both mosquito-nets and mosquito-proofing, and by whom, it is no exaggeration to say, the former is uniformly disliked whilst the latter is universally blessed. The chief value of mosquito-proofing, and that on which its installation must be justified, is the prevention of malaria.

Editorial.

TUBERCULOUS DISEASE IN CHILDREN.

It has long been known that tuberculosis in children may be due to the bovine or to the human type of bacillus. It has also been recognized that bovine bacilli derived from milk may invade the abdominal organs and cause much tuberculosis in children under 15 years of age. But Dr. Stanley Griffith has shown that the bovine type is not responsible for the chief mortality from tuberculosis in childhood. Only about one-third of tuberculous meningitis in children is bovine; in bone and joint disease the human type preponderates over the bovine; while pulmonary tuberculosis in childhood is almost invariably human in origin.

Much controversy has arisen as to the paths by which infection enters the body. Whether the disease is air-borne or food-borne has been much debated. It has been asserted that pulmonary tuberculosis is primarily food-borne and a disease of childhood, which may lie latent for years and then flare up in adolescence under the strain of rapid growth, fatigue or malnutrition.

Dr. Blacklock has had the opportunity of investigating a large series of cases of tuberculosis in infancy and childhood and of ascertaining to what extent death could be attributed to the various types of bacilli, and the particular pathological lesions with which they were associated. By combining pathological and bacteriological findings he has been able to give a more definite opinion as to the portal of entry of the invading bacilli. A Report of his investigations has been published by the Medical Research Council.

Dr. Blacklock's researches extended over eight years and have been mainly concerned with the evidence of tuberculosis in infants and children up to 13 years of age dying in the Royal Hospital for Sick Children at Glasgow, either from illness or the result of accident. In a series of 1,800 consecutive post-mortems, tuberculous lesions were found in 283, or 15·7 per cent. In all of them the situation of the most advanced lesions, either in the organs themselves or in the related lymphatic glands, was as far as possible decided. In the first 216 tuberculous cases, in 3 of which there was a double portal of entry, an attempt was made to isolate the infecting organisms from the lesion at the primary site, or more often from the related tuberculous glands. In 36 specimens the infecting bacillus could not be isolated. From the remainder 183 strains were obtained, while in 6 cases bacilli were also isolated from secondary lesions as well, making a total of 189 strains obtained from autopsy material. From the surgical wards 65 specimens were sent for examination, and from this material 52 strains were isolated. Direct culture was used with all the

specimens, and inoculation of guinea-pigs was reserved for cases in which culture alone seemed likely to fail in isolating the infecting organism.

As most of the material was obtained post mortem it was treated with 7·5 per cent antiformin for a period of twenty to thirty minutes in order to destroy contaminating organisms. The tissue-antiformin mixture was centrifugalized and the sediment washed twice with distilled water before being injected into guinea-pigs or used for culture.

Egg media, with and without the addition of 6 per cent glycerine, prepared according to Wilson's method, were chosen as standard. Of the 152 human strains studied 132 were obtained by direct culture and 20 were isolated through guinea-pigs. Of the 89 bovine strains 50 were obtained directly by culture and 39 through guinea-pigs. Human strains were found to be easier to isolate by cultural methods than bovine, particularly when the bacilli were present in small numbers in the material.

In the determination of the type of bacillus the morphological characters were noted to be uncertain. The majority of the strains (78·3 per cent) typed as human were long and beaded, while 60 per cent of those typed as bovine were short and showed no beading.

The differential diagnosis of eugonic from dysgonic types was based on the cultural characteristics and in particular on the amount and rapidity of growth in primary and subsequent four cultures, when necessary, with corresponding transfers to media containing glycerine. For this purpose glycerine egg and glycerine potato were found to be better than glycerine serum. Of the 152 human strains 134 were typically eugonic and the majority of these produced pigment as well. The other 18 strains were less eugonic, but all produced pigment. Of the 89 bovine strains 77 were typically dysgonic in transfers made to glycerine media from the primary growth and from the subcultures. It was found that while sharp differentiation was possible in most cases, it failed with a few strains which had some cultural similarities. The differentiation of slowly growing human strains and rapidly growing bovine strains gave rise to some difficulty, but repeated subcultures usually enabled a classification to be made. Griffith found it necessary to subculture certain human strains as far as the twentieth generation before deciding that they were human. Dr. Blacklock found that strains showing eugonic characters with yellowish or reddish pigmentation in primary cultures and early subcultures were always human, while strains which were dysgonic and did not produce pigment in primary and subsequent subcultures were bovine. Of the 89 bovine strains 85 showed marked virulence for the rabbit; 0·01 mg. of a bovine culture injected intravenously produced generalized tuberculosis, the lungs being riddled with small lesions. A similar dose of a human strain usually caused only minimal lesions. In the case of variant strains the rabbit virulence test was always regarded as the chief test for differentiation.

Dr. Blacklock found that in 61 per cent of the cases with tuberculous

lesions the primary infection was in the thoracic tissues (lungs or lymphatic glands). He points out that Villemin, in 1868, was the first to suggest that pulmonary tuberculosis was caused by the inhalation of material coughed up by phthisical subjects. In 1886 Koch declared that infection was caused almost solely by the inhalation of dried pulverized sputum which contained tubercle bacilli. In 1906, however, Von Behring stated that infection occurred commonly in infancy and that the portal of entry of the tubercle bacilli was by the alimentary tract. The bacilli passed through the mucous membrane of the pharynx or intestines and related lymphatic glands, without producing any lesions, and eventually reached the lungs or bronchial glands, where they might produce tuberculosis at once, or lie latent for years until the resistance of the subject was reduced by illness or other cause. Calmette supported Von Behring, adducing animal experiments to prove the theory. Many experiments have been made by other observers in support of these views. Animals were fed with enormous doses of tubercle bacilli without sufficient precautions, and experimenters were oblivious of the fact that these doses swamped the animal's normal resistance. Cobbett, working with *B. prodigiosus* and also with tubercle bacilli, found that infection occurred more readily by inhalation than by feeding. Kossel, Weber and Heuss, Findel and Reichenbach used estimated doses of tubercle bacilli and found that much larger doses were required to infect an animal by the alimentary tract than by inhalation.

Dr. Blacklock points out that all these animal experiments are subject to the criticism that in the human subject there may be modifying influences at work, such as mild inflammatory conditions of the lungs and bronchial glands which, by lowering the body resistance, render them more open to attack by the tubercle bacillus. Similarly, the mesenteric glands and bowel might be infected by a smaller number of bacilli if there was enteritis present. Findley has shown this to be the case with rabbits.

In view of the unsatisfactory evidence obtained from animal experiments, Blacklock looked for the characteristic lung lesion described by Parrot and Kuss as corresponding to the primary lesion in the human subject. They found the primary focus was composed of a patch of tuberculous broncho-pneumonia, which showed a tendency to heal. The lymphatic glands at the hilum of the lung were the seat of a similar lesion. The alveolar walls were swollen and the air spaces filled with fibro-cellular exudate in which there were numerous tubercle bacilli, but no endothelial or giant cells. The primary lung lesions showed no relation to vessels and the authors concluded that the foci were due to the inhalation of the infecting organism. At a later stage there was a tendency to encapsulation and repair, which was peculiar to the primary focus and distinguished it from the secondary lesions which were progressive.

For a better understanding of the mechanism of infection and the spread of infection, Dr. Blacklock states that it is necessary to understand the anatomy of the lymphatic system of the lung. The researches of various

authors and his own studies have shown that the lungs are fairly sharply marked off into definite lymphatic territories which drain into the related tracheo-bronchial lymph glands at the hilum. These glands are strictly regional and have no direct connection with the lymphatic glands in the neck or abdomen. The efferents from these glands drain almost directly into the blood-stream and so tuberculous infection can be readily spread throughout the body by this means.

In his research into the existence of a primary lung lesion, Dr. Blacklock found the site of infection was thoracic in 148 out of 173 cases. In most cases the primary foci were single, and in eighty per cent were the size of a hazel nut or smaller. The primary lesions were most often in the right upper lobe, then, in order, in the right lower, left upper, left lower, and lastly in the middle lobe. The tracheo-bronchial glands in direct anatomical relation to these foci were always diseased. Both on naked-eye and microscopic examination, the lesions in the primary focus and related lymph glands were of the same age, or those in the glands more recent, so that on this account a lymphogenous origin of the pulmonary focus was unlikely.

A study of the histology of these primary lesions showed that they were of the nature of a localized patch of broncho-pneumonia and thus were probably due to inhalation of tubercle bacilli. None of them could be demonstrated to have a vascular origin. Unlike the secondary broncho-pneumonic patches, the primary lesions always showed attempts at healing. The lesions in these primary foci were obviously similar to those described by Kuss and other workers to which we have already referred.

Dr. Blacklock asks, What is the significance of these single primary foci? If they were aerogenic, as the evidence seemed to show, one would have expected multiple foci to be found in a susceptible child inhaling large numbers of bacilli from contact with an "open" case of pulmonary tuberculosis. Other unknown factors must be at work in localizing the lesion. It is possible, of course, that only the tubercle bacilli which reach the alveoli are capable of producing a lung lesion, those which are arrested in the bronchi being destroyed by phagocytes or passed to the lymph glands for destruction.

As further evidence that the primary foci in the lungs are not of hæmatogenous or lymphogenous origin, Dr. Blacklock points to the fact that from these lesions, or from the lymph glands in direct relation to them, only human types of bacilli were isolated. If the foci were of hæmatogenous origin bovine bacilli should have been frequently found; as there were numerous cases with primary abdominal lesions in the same series as the lung cases, and from eighty per cent of the abdominal cases bovine bacilli were isolated. Further, from cases with tuberculosis of the bones and joints bovine bacilli were obtained, and these lesions are known to be of hæmatogenous origin. Some eighty-six per cent of the cases with primary lung lesions of human origin were city children, who, therefore,

from conditions of housing, &c., ran greater risks of air-borne infections. In primary abdominal tuberculosis severe lung lesions are often found, but these are of a secondary nature.

From three cases considered as primary lung infections Dr. Blacklock isolated bovine bacilli from the tracheo-bronchial glands. No primary lung lesions were found, but the distribution in the lymph glands corresponded to the primary lesions in which human bacilli were found, and it seemed probable that the infection came from the lung. "Open" respiratory carriers of the bovine type are known, and are commoner in Scotland where they constitute 3·8 per cent of patients expectorating viable tubercle bacilli, as compared with 1 per cent in England and 0·3 per cent on the Continent.

In only five children, all of whom were over two years of age, out of the 173 with primary lung infections had the tuberculous lesions not been the cause of death. Thus in Scotland it seemed that nearly all the children with lesions in the lungs or tracheo-bronchial glands died in childhood as the result of tuberculous disease. Dr. Blacklock's finding is in marked contrast to the cases reported by American and Continental workers, and against the conclusion of many foreign workers that pulmonary tuberculosis in the adult is due to a recrudescence of the tuberculous lesion in the lung contracted in infancy.

The higher mortality from tuberculosis of the lungs in Scottish children is difficult to explain. The racial resistance in Scottish people, owing to difficulties of communication in the past, may be less than that of other countries. In New York City the mortality rate from tuberculosis is much higher in Scots than in French, Germans and Russian Jews. Other factors such as diet, climate, and housing conditions may also play a part.

In 101 cases (35·7 per cent) of the total 283 cases with tuberculous lesions the pathological evidence pointed to the site of the first infection being abdominal. Of these, 18 showed evidences of intestinal ulceration; in the remaining 83 cases no ulcers were noted, but the mesenteric glands were the seat of tuberculous adenitis.

The greatest number of primary abdominal lesions was found in the second year of life, at the period when children are consuming large amounts of raw milk. There were fewer secondary lesions and less extensive glandular involvement in the abdominal cases than in the thoracic.

From the abdominal lesions twelve human and fifty-four bovine strains were isolated. The greatest number of abdominal infections with the human type of bacillus was found in children aged 9 to 18 months, viz., when children commence to crawl and walk, and are liable to pick up infection from the ground and floors. In more than half the abdominal infections with human bacilli there was a family history of tuberculosis.

The high incidence of the bovine type of infection in abdominal cases is thought to be due to the ingestion of infected milk. In breast-fed infants there was only one case of abdominal tuberculosis—and that with the

human type—while at corresponding ages in bottle-fed babies there were two human and fourteen bovine infections. Country children were slightly more infected with the abdominal bovine type than Glasgow children, as in Glasgow the milk is pasteurized and under strict sanitary and veterinary control.

Blacklock has compared the frequency of the two types of tubercle bacilli found in different countries in children's tissues. In Berlin the percentage of bovine strains was 4·3, in Christiania 7·8, in London 18·2, and in Glasgow 32·3. He considers the greater percentage in Glasgow to be partly due to the greater incidence of primary abdominal tuberculosis in Scottish children, due to bovine bacilli.

On comparing the lesions found at autopsy due to infection with human strains with those due to bovine strains, generalized miliary tuberculosis, cerebral tuberculosis, and bone lesions were more commonly associated with the former type of bacilli than with the latter.

From surgical material taken during life, Dr. Blacklock obtained fifty-two strains, and from autopsy cases ten other strains. Of 28 cases of tuberculous cervical adenitis, 10 were infected with the human type of bacillus and 18 with the bovine. In 26 cases of tuberculosis in bones and joints, 17 were due to infections with human strains, and 9 with bovine. The incidence of bovine infection in bone and joint tubercle is slightly higher than that recorded for English children, and much higher than that given for Continental children.

In 1,000 of the cases in the series of children, von Pirquet tests had been performed, and in 466 of the cases Mantoux tests had also been performed under similar conditions. The percentage of positive results was found nearly the same as the percentage incidence of tuberculous lesions found at autopsy in the first and second years of life, so nearly all the children with positive tuberculin reactions in the first two years of life must have succumbed to the tuberculous infection. These results confirm the finding of Dr. Hart, to which we referred in an Editorial in 1931; that in the infant a positive tuberculin reaction must be regarded as a grave prognostic sign.

Clinical and other Notes.

THE TROJAN AMBULANCE CARRIER.

By Colonel E. M. COWELL, D.S.O., D.L. (T.A.).

The International Committee of the Red Cross at Geneva have been inquiring for the past year or two into the best means of adapting motor vehicles for ambulance purposes. (Report by General Rouppert, C.I.C.R., Geneva, 1931.)

Some five various devices have been described, one of which, Colonel Tintner's apparatus, has been examined and tested by the War Office.

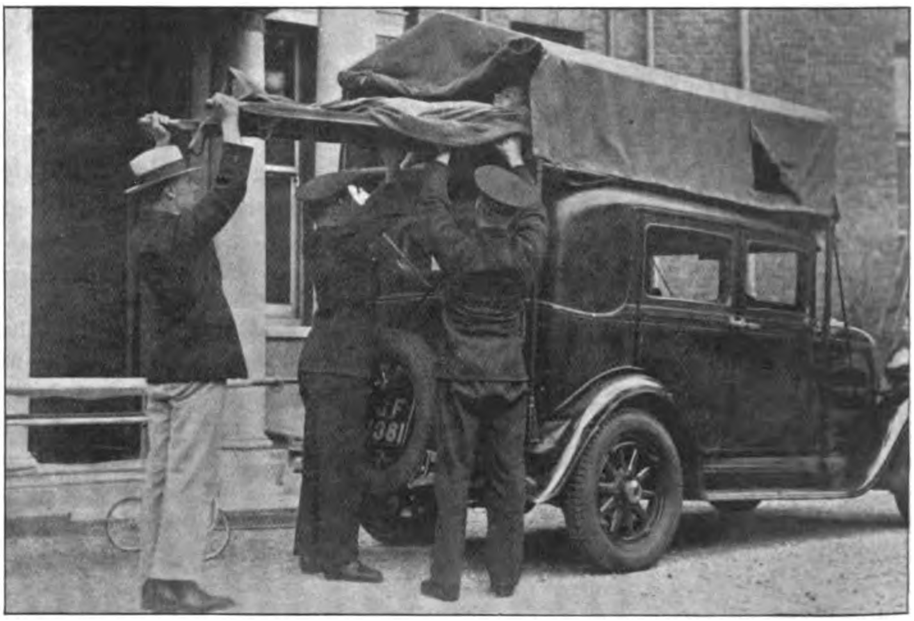


Fig. 1.—Loading the carrier.

This is a heavy cast-iron apparatus, made to fit into a lorry and capable of carrying four stretcher cases. No special cover has been devised, if the vehicle used is an open lorry.

In General Rouppert's report it is definitely stated that a saloon car cannot be adapted for ambulance purposes.

The ambulance carrier, here described, has passed satisfactorily all its tests and has been used successfully as an emergency ambulance car. (Fig. 1, view of complete carrier being loaded.)

The apparatus consists of detachable parts, made of tubular steel, which are fitted on to base supports, permanently attached to the chassis of any 4-5 seater type of car (of 12-horse power or over). Auxiliary rear springs should be fitted for bad roads.

Four verticals support a horizontal framework above the roof of the car. On this framework are two pairs of grooved rails to take two Service stretchers. A sheet below prevents draughts and the whole is covered by a canvas roof. Two port-holes allow of observation of the patients on the road. A light and a communication cord to the driver are easily fitted.

There is enough room to take two patients with Thomas's splints slung to a suspension bar. The apparatus allows of one stretcher to be centralized. This permits of a semi-Fowler position for an abdominal case. The stretchers can be fitted with a frame to carry mosquito netting, if required, in malarial districts.

Fig. 2.—Storage when not in use.

No difficulty is experienced in loading. If the bearers are exceptionally short men, they stand on biscuit or petrol tins for the actual loading.

The whole carrier apparatus is perfectly rigid, lateral movement is prevented by cross-bracing between the rear verticals, and fore and aft motion by forestays.

The apparatus weighs 144 pounds. It is not bulky and is conveniently stored on a stretcher or in the corner of a garage (fig. 2).

The assembly and erection can be carried out in a few minutes and are easy to learn; little instruction is necessary.

Road tests have been carried out, and a standard saloon car fitted with the carrier has carried over rough ground two 12-stone lying cases, two sitting, a driver and an orderly, and on a good road a speed of over fifty miles per hour was attained.

The base pieces have to be prepared and fitted permanently to the particular type of car chosen. This takes a few hours. When this is done the apparatus can be erected in five minutes and dismantled in three.

It is possible to erect the carrier for use as a tent, using special base pieces which are secured by iron pins driven into the ground. A side curtain completes the tent and shelter is provided for four stretcher cases.

FIG. 3.—In use as a tent.

If required, the tent can be used as a dressing tent.

The maintenance cost of an ambulance car, garage fees, insurance charges, are eliminated, by the use of the ambulance carrier.

In any emergency it will be easy to organize an Auxiliary Ambulance Service through one of the existing First Aid Societies.

Once the base pieces are attached to a car the rest of the apparatus is standard and interchangeable.

The manufacturers can turn out large numbers of these ambulances in a short space of time.

The cost is £37 in this country and the apparatus is made by the Trojan Company, Ltd., of Croydon.

SOME CASES OF MALARIA.

BY MAJOR R. A. MANSELL, M.B.E.,
Royal Army Medical Corps.

IN few diseases do unusual manifestations tax the brains of the clinician to such an extent as is the case with malaria; in fewer still does the time inevitably spent before accurate diagnosis is achieved matter so much to the patient. It has been held by some teachers for many years now that malaria is essentially a curable disease: for myself, the more I see of it the more I subscribe to this doctrine, with the absolute proviso that the disease must be taken in its initial stages. When the infection is by *Plasmodium falciparum* then the time spent in arriving at a diagnosis may, literally, be of vital interest to the patient. The only excuse for publishing these notes is that they may assist some who are perplexed in their early contact with practical tropical medicine and have not yet been impressed with the truth of the dictum which I heard a number of years ago from the lips of a then senior officer of the Corps. Requested by a fellow medical officer, with whom I was working, to see a case of some difficulty he asked, after hearing the history, what the suggested diagnoses were. "Possibly malaria." According to his invariable custom the clothes and bed-clothes were then completely removed from the patient who was subjected to somewhat prolonged and detailed scrutiny. "Well, the patient's evidently not pregnant, and that's about the only thing that malaria won't simulate, so you may be right!" Things like that stick in one's mind, and if they stick, so to speak, in the right part of it, they can be of inestimable use in tight corners. Actual cases, too, stick, and are often of help in more or less direct ways: they lead, I suppose, to the formation of a clinical sense, so much more marked in our predecessors who could not rely on, or indeed call for, the mechanical "aids" to diagnosis on which we nowadays tend to lean so heavily for support. Let this be the reason for the recording of some cases which came within my experience some years ago in the north of the Punjab. These records are purposely made in a colloquial rather than a purely scientific manner: those to whom they may be of use will remember them better so; those who desire further acquaintance with the detailed pathology of the conditions mentioned will have no difficulty in turning them up in the textbooks at their disposal. In any case, I have at present nothing to add to the findings of those who are my betters pathologically.

One of the most difficult and dangerous pitfalls prepared for the practitioner, especially of tropical medicine, is sudden and unexpected hæmorrhage. When that phenomenon presents itself as a manifestation of malarial infection it usually spells "malignant," and as such demands all the more urgent treatment. Hæmorrhages from such a cause have been recorded as having occurred into practically every one of the organs and

tissues of the body. Here are three cases which occurred within a month of each other towards the end of a year. They are placed in order of severity as a sequence and not as they actually occurred in point of dates. I would like to note now that these cases were treated some years ago, and that the treatment which my notes tell me I then meted out would not necessarily be that which I should desire to give to-day.

Firstly, then, an officer. He had suffered at previous intervals of approximately a month from "sandfly fever" and "influenza," or so he informed me. On this occasion he reported in the morning with fever and was sent to bed in his quarters. A blood-smear taken at the time was reported to contain "numerous malignant tertian parasites," and ten grains of sulphate of quinine were prescribed in a mixture thrice daily with a suitable initial purge. That evening I became acquainted with the case as orderly medical officer on an urgent call. There had supervened on his fever, which was still present up to 104° F., the symptom of vomiting. This was recurring regularly at intervals of twenty to thirty minutes, was small in quantity and accompanied by a moderate degree of epigastric pain: the material vomited resembled in appearance nothing so much as a "typical bacillary dysentery stool." His spleen was enlarged to a full finger's breadth below the costal margin apart from any movement due to respiration, and was hard. The vomiting was controlled by the administration of a remedy found on the patient's dressing table—four minims of tincture of iodine in half a tumbler of water taken in sips. He was then moved to hospital and immediately given ten grains of hydrochloride of quinine in water by the mouth, his vomiting having ceased. This salt of quinine was continued at a total of thirty grains daily for three days and followed by a similar dosage of the sulphate for a week, the patient being confined—much against his will—to bed for that period. No further fever occurred nor were parasites again demonstrable in his blood.

Next, another officer who was known to have had several severe attacks of malaria, so far as could be ascertained all of the "benign" type, and whose spleen was hard and enlarged to two finger's breadth below the costal margin. While in camp with his battalion he developed an increasingly severe diarrhœa with abdominal pain and a slight increase of temperature—to just about and over 99° F. It seems clear that there was then no naked-eye suggestion of anything dysenteric about his stools, but with the rise of temperature and as the diarrhœa did not yield to the remedies available in camp he was despatched to hospital in Cantonments, some three hours' journey by passenger train, he being then well able to care himself and in no way markedly ill. When met at the station he was seriously ill and in a condition rivalling the best journalese descriptions of the early days of the evacuation of dysentery cases from the Mesopotamian force. At no time did he suffer from vomiting, but when he arrived in hospital he was passing frequent and painful small stools consisting almost entirely of blood, although not long previously a mucous element had apparently

predominated. It may here be stated that early and careful examination in a laboratory next door to the hospital failed to reveal any dysenteric organism. What exactly there was about his appearance that made me insist on it my notes do not reveal, but while a blood-smear was being examined he was given 10 gr. of quinine hydrochloride by the mouth and within a couple of hours the dysenteric symptoms had entirely ceased. The blood-film showed a moderately severe infection with *P. falciparum*, ring forms only being found. This patient's temperature, whilst he was under my observation at any rate, did not rise above 100° F., and under similar treatment to that recorded above, followed by a course of stovarsol (120 grains in ten days), he made an uninterrupted recovery.

The third was the case of a soldier who was brought to hospital in the afternoon, about tea time, from his barrack room. He had previously had no malaria that he himself recognized as such, nor could any documentary evidence be found to suggest that he might have been infected. Briefly, he had had diarrhœa for the preceding twenty to twenty-four hours, but without pain and not of sufficient severity to cause him to report sick that morning. He did not appreciate that he had, or had had, any fever. Suddenly, just before 4 p.m. he had an attack of severe abdominal pain and passed a stool which he discovered to consist of "slime streaked with blood"; the pain continued and he felt definitely very ill. He arrived in hospital at about 4.30 p.m., and happening to be there I saw him immediately. He then presented the picture of a moderately severe degree of collapse, but his temperature was 103·4° F.; his spleen was not palpable. Whilst he was being examined he had another severe attack of abdominal pain with considerable tenderness over the whole of the lower abdomen, and then passed *per anum* a large quantity of fresh blood streaked with what looked like light yellowish epithelial strands. Simultaneously he vomited some three ounces of what can only be described again as "typical bacillary dysentery stool"; he also passed *per urethram* some five ounces of apparently pure fresh blood. His condition of collapse increased markedly as a result of these manifestations, and he was definitely very seriously ill. So typical was this picture, to those who had seen it before, as we both had, that the Assistant Surgeon on duty went hurriedly to prepare a syringe and some quinine solution and I took a blood-film and followed him to examine it if I could before the syringe was ready, leaving the Sister with instructions to deal with the condition of collapse. On returning to the bedside, now only some fifteen minutes after the patient had been put to bed, it was obvious that his condition had vastly improved, and casual conversation during the cleansing of his arm preparatory to giving the injection revealed the fact that his intestinal disturbance had so far subsided that he had, in the short interval, swallowed and retained the better part of a pint of tea (whence obtained was not precisely determined). Militant procedures were, therefore, abandoned and he was given quinine by the mouth, as were the cases noted above. He, also, made an uninter-

rupted recovery. The blood-film which was taken showed practically every red corpuscle infected with *P. falciparum* rings; careful examination of the stools failed to reveal any dysentery organisms.

These cases illustrate, in varying degrees, the condition once known as "Peshawar fever," and though the terminations here were eminently satisfactory it is to be remembered that the mortality under this heading was once enormous before its true malarial origin was recognized; nor does it need stressing that the elements of fatality were present in these cases also had diagnosis and treatment not been correct. I claim no great clinical credit; I was taught this by the senior officer whose remark I quoted at the beginning.

Two other perhaps not usual cases come to my mind. Again I give nothing but the clinical pictures.

The first is the case of a large and healthy Sikh soldier—a sapper—who fell in the riding school at camp and dislocated his right shoulder. This in the early morning. Ordinary manipulations failed to reduce the dislocation, so just over half an hour later, I have it recorded, he was given only sufficient chloroform to overcome the spasm and reduction was effected. Within half an hour after that he produced the most perfectly typical malarial rigor that I have ever seen and a blood-film full of benign tertian malarial parasites. To the best of his knowledge he had not had malarial fever for some two years previously. As a demonstration of "post-operative" or "traumatic," malaria that case has always stuck in my mind and cropped up at useful moments.

Some two years later just before leaving the hospital rather late one morning I was asked to look at a man in the surgical ward. He had crashed off a motor bicycle two days previously and had been brought in mildly concussed but without any obvious or discoverable injury; he had, in fact, progressed rapidly and well. On going to remove the plates from his midday meal the Sister noticed that he was dull and somewhat stuporous—possibly the after-dinner nap; however, not apparently being quite satisfied she went back shortly to look at him again and found that condition increased. True, he might well have been suffering from some progressive intracranial condition, everything suggested it—almost. It took less than fifteen minutes to demonstrate considerable numbers of malignant tertian rings in his blood-film and to have five grains of quinine bihydrochloride injected into his blood-stream. In less than an hour he was a normal individual and took the rest of his quinine like a man. He had never previously had malaria.

An instructive series of cases came to light on the return of a laboratory, with which I was at the time associated, from the hills to the plains at the end of the hot weather. There was then starting, statistically, a small outbreak of "sandfly fever." Everything was being done, and appeared to be, according to rule: no malarial parasites were found in blood-smears; the patients complained of marked backache as an outstanding symptom,

a short, sharp fever subsiding in three to five days without specific treatment and without indication of other disease or infection ; but one morning, when verifying his ward reports, the medical officer found albumin in the urines of some of the patients.

Specimens were then sent to the laboratory where the finding was confirmed. Interested, I went to see the cases, and in fact saw seven of them, all with albumin in their urine.

Now it was true that these men had backache, but their pains were in the kidney region and not in the lumbo-sacral area which is the site of the "sandfly fever" pain.

Blood-smears were sent to the laboratory, and when I returned there my assistant surgeon reported that he could not see any malaria parasites. He could not: but, again, he was suffering from an acute progressive myopia to which he would not previously confess and which was then discovered as I saw the parasites with ease; they had not been seen in the ward owing to "trouble with the Leishman's stain."

Here was a series of original benign tertian malarial infections, some dozen in all, with the short indefinite fever, recovering automatically, which is not uncommon and which reappears often in about a fortnight as a frank malarial attack, and with simple ulbuminuria as a complication. In all but one of these cases the albuminuria disappeared within a couple of days of the cessation of the fever; in one it persisted for ten days. In none of the cases was there any abnormality present in the urine except the albumin. This is a recognized complication of the disease and the above is its usual course.

In association with quartan infections a definite nephritis is not uncommon, and was, indeed, recognized possibly by Hippocrates.

Of these cases one might say that "sandfly fever" may be almost as atypical as malaria—many others than myself must have occasionally been more than surprised at the signs and symptoms of patients whose sheets have borne this diagnosis: they do, however, emphasize the necessity for careful personal checking of all the stages of diagnosis.

Again, I make no apology for these notes except that they are of not quite straightforward cases the solution of which has stayed in my mind, apart from the notes I have had of them, and helped me in dealing with others when the mere reading of textbooks would probably have passed into the memory of where such and such information could be found. The serious occurrences in malaria usually take place, and demand treatment, with such rapidity that a vivid picture of their possibility is, to me at any rate, an essential in the preparation for dealing with them.

Echoes of the Past.

THE WATERLOO CAMPAIGN.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps (R.P.).

When Napoleon escaped from Elba and entered Paris in March, 1815, the onus of the defence of the Netherlands devolved on the British and the Prussians. In June, when his intention to cross the frontier became apparent, Blucher, commanding the Prussian army, with his headquarters at Namur, was watching the line of the Meuse and the Sambre beyond Charleroi, Wellington with six divisions of British and Hanoverians, a cavalry corps, and Dutch and Belgian troops, occupied the country between Brussels, which he made his headquarters, and Ostend. The nominal strength of the army under Wellington's command was about 106,000, but a third of the force consisted of Netherland troops whose loyalty was a very uncertain quantity and had to be discounted accordingly.

The nucleus of the British Expeditionary Force consisted of 5,000 troops already in the Netherlands under Sir Thomas Graham, who had taken part in the campaign of Bergen-op-Zoom. Most of the Peninsular veterans were with the army in America, or had been disbanded. The units sent from England were therefore, many of them, second battalions, both weak and imperfectly trained.

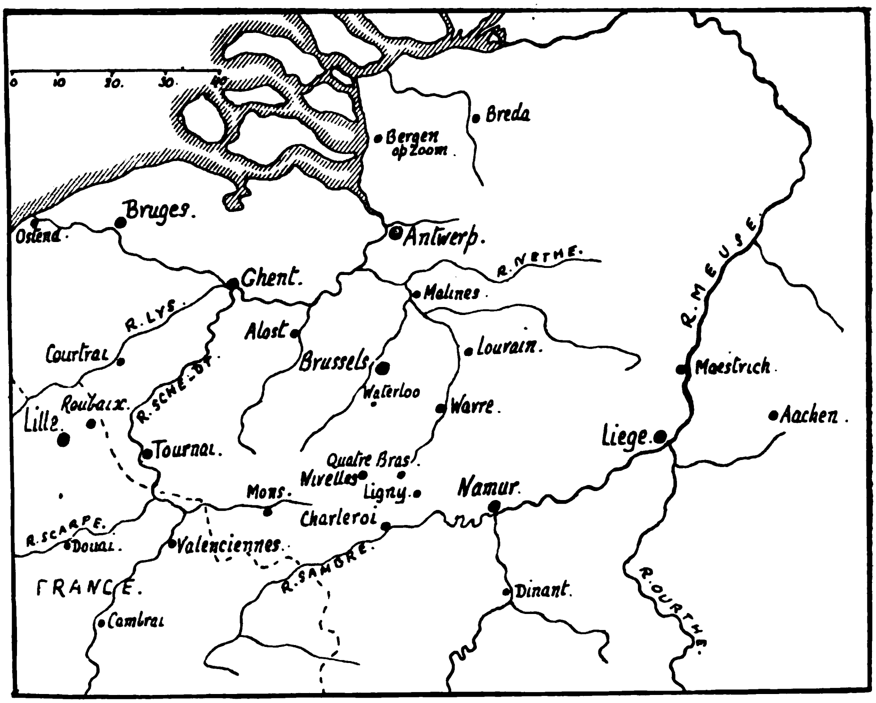
The original medical establishment, as ordered for the army of 40,000, provided for an inspector of hospitals, 3 deputy inspectors, 3 physicians, 13 staff surgeons, 22 hospital assistants, a purveyor, 3 deputy purveyors, 3 apothecaries, and 4 dispensers. Most regiments had a surgeon and two assistant surgeons. The divisional surgeons W. Taylor, J. Gunning, S. Woolriche, J. R. Hume, and G. Denecke had served in the Peninsula. The P.M.O. was James Robert Grant.[1] The Ordnance Medical Department was represented by Deputy Inspector W. Wittman and 9 officers.

The arrangements were on the general lines adopted in the latter days of the Peninsular War. Each unit had a spring cart, and the surgeon an allowance to provide a mule for his panniers. A general hospital was opened at Ostend, and, by June, others had been formed at Brussels,

[1] Sir James Robert Grant, K.H., Surgeon's Mate 1792, Staff Surgeon 1795, Deputy-Inspector 1807. Served in Flanders, in the Expedition to the Cape, and at Walcheren, C.B. 1850. Died 1864, aged 91. Described in his obituary as "tall, of a commanding presence, and with an air of courteous dignity." He was a brother of Colquhoun Grant, Wellington's Intelligence Officer.

Bruges, Antwerp and Ghent. The Hanoverians were provided for in the British hospitals.

Tents were embarked in the proportion of thirty to a battalion, but were only issued as required. Each soldier carried a blanket which he was prepared to use as a bivouac tent. Great coats were called in to store at Ostend. The ration fixed was bread 2 pounds, meat $\frac{1}{2}$ pound, barley or rice $\frac{1}{4}$ pound, and brandy $\frac{1}{8}$ quart. As regards dress, the shako had come in during the Peninsular War, and the long-skirted coat had been replaced by the coatee. Trousers and ankle-boots were worn. The medical officers wore cocked hats with black feathers. Captain Mercer of



the Artillery mentions one who at a critical moment of the fighting appeared with an open umbrella.

On June 16, Napoleon, who had hoped by a rapid advance to separate the British and Prussian armies, and destroy them in detail, was engaged simultaneously with Blucher at Ligny and with Wellington at Quatre Bras. Blucher was forced back on Warre. Wellington began the battle with 7,000 men against 19,000, but his numbers gradually rose to 22,000, and the French were compelled to draw off. The British and Hanoverians at Quatre Bras had 350 killed, 2,380 wounded and 181 missing. The wounded were collected during the night, and taken into Brussels, where they were well provided for. The French were less fortunate; numbers

of their soldiers were left to die of neglect in the streets of Charleroi. The heavy rain, which was now falling, began to render the passage of wheeled transport on the roads a difficulty.

On the evening of June 17, in anticipation of a junction with Blucher's forces, Wellington occupied a position astride the Charleroi road on a low ridge twelve miles south of Brussels. The Forest of Soignies in his rear, traversed by several forest roads, afforded reasonable access to his base in case of a retirement. In the great battle of the following day about 63,000 men of four nations and of much varying quality were opposed to 70,000 Frenchmen, mainly veterans. Commencing about noon, Napoleon launched five great attacks with both infantry and cavalry on different portions of the Allies' Line. These were supported by the fire of artillery, in which arm he possessed a great superiority. The last assault, that of the Guard, was repulsed about 8 p.m., when the Prussians, who had been delayed by the broken state of the roads, having come into line, a general counter-attack was delivered which drove the French from the field in complete disorder.

The British losses, 1,417 killed, and 4,923 wounded, reached something like twenty-nine per cent.; and in addition 582 were reported missing. The total casualties of the Allies, excluding those of the Prussians, are given as 2,947 killed, and 9,929 wounded. The endurance shown by the young second battalions under the prolonged strain of artillary bombardment won the admiration of Europe.

The medical officers seem to have come off remarkably lightly. George Denecke, P.M.O., 3rd Division, mentioned in General Allen's despatches, was wounded on the 16th, and J. Stewart the Assistant-Surgeon of the 2nd Gordons, a regiment which lost half its strength, was also hit. It is probable that the brigade dressing stations, where every available surgeon was needed, were favourably situated behind the ridge held by the infantry, but there is no reason to doubt that the usual proportion of junior officers was in the firing line. Mercer's medical officer, Hitchins, was with the guns, and Whymper of the Coldstreams and Good of the 3rd Guards were in the thick of it at Hougomont.

How far the British and Hanoverian medical arrangements worked out according to plan it is hard to say. Those of the Belgians and Brunswickers were imperfectly organized. Eight or ten men were observed to leave the ranks at one time under pretext of helping wounded to the rear, and casualties of all nationalities found their way into our dressing stations and overflowed the hospitals. Much voluntary assistance was rendered by the inhabitants of Brussels both in feeding the wounded and admitting individual patients to their homes. The Brussels road was blocked with traffic and badly cut up. Crowds of walking wounded streamed along it during the action, took refuge in the cottages or lay by the roadside.

Here many died and were buried. At the end of the day 40,000 men and 25,000 horses lay dead or wounded within an area of two miles, and from these the severely wounded had to be extricated, a task which took four days. The inn at Waterloo, which Wellington had made his headquarters, became, by force of circumstances, a field hospital, for nearly all the staff were wounded. The future Lord Raglan, who was military secretary, rode in with his elbow shattered, and entered the room where the Prince of Orange and others were lying. Gunning, the surgeon, decided on immediate amputation. The Prince used to relate that "not a word announced the entrance of the patient, nor was he conscious of his presence till he heard him call out in his usual tone 'Hallo, don't carry that arm away till I have taken off the ring!' Not a groan, not a sigh nor a remark had been extorted either by the wound or the operation."[1] Lord Uxbridge, the cavalry commander, whose leg was amputated, showed equal fortitude. General Picton, who was killed leading his division, had been hit by a spent ball at Quatre Bras, which broke two ribs and produced a huge hæmatoma. He had, however, concealed the wound, which at the time of his death was already gangrenous.

On Monday morning every available vehicle was sent up to the battlefield. The fracture cases suffered agonies on the broken roads. That day the British advanced to Nivelle, after despatching parties in the proportion of an officer, N.C.O., and three men for every hundred casualties, to work in the general hospitals.

During the next month the wounded Frenchmen scattered over the surrounding country were gradually brought in. The inhabitants were hostile, and they were mostly in a miserable condition. Some had supported life by gnawing the flesh of dead horses or even, it is said, of their dead comrades. The disposal of the bodies of the slain became a pressing matter. The peasants from miles round were collected and compelled by Prussian soldiers at the bayonet's point to bury or burn the putrefying corpses of men and animals. Large pits were dug into which the remains were dragged with iron hooks.

A number of wounded found their way back to their billets in Brussels where they were well cared for by the inhabitants. A week after the battle these were still uncounted. On the 26th Dr. Grant wrote to Wellington that he had organized the hospitals, and was joining headquarters. Evacuation to Antwerp was proceeding, but, so far, no transport was available for the general hospitals prepared at Bruges, Ghent, and Ostend. He inclosed a state showing 2,376 British and Hanoverian wounded in hospital at Brussels, 2,466 at Antwerp, and 900 Brunswickers at Merxem and Lacken. There were also about 2,500 sick prisoners.

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[1] Dorsey Gardner.

A subsequent return gave the number of wounded Other Ranks as 6,831; 856 had died of wounds.

As regards the surgery of the campaign, the opinion of a contemporary of the distinction of George James Guthrie cannot be ignored, though he was never one to understate his case. He was then on the half pay of a deputy inspector, but hurried across to Belgium on the news of the battle. He wrote: "Within one year of Toulouse the Battle of Waterloo took place. The army was not the Peninsular army, neither were all its doctors. Few, if any, of the medical staff officers had seen a field of battle. I found the assistant surgeons doing everything they should not have done. The greatest efforts were made to obviate this state of things. Amateur surgeons flocked over from London. They rectified these evils as far as they could, but nothing could recall the past or the irretrievable mischief insufficient care had occasioned in the first few days."

To many who had not come under Guthrie's influence a gunshot fracture of a long bone meant the loss of the limb. There is no doubt that, in the stress of battle, arms and legs were sacrificed which could have been saved. One officer related how, in proceeding to the rear, he was saved by the fire of the enemy from three successive surgeons who were preparing to amputate his arm, which, in the end he preserved intact.

The civilians who came over found their chief employment in dealing with the French wounded who were brought in late. Staff Surgeon John Hennen[1] wrote of the Gensdarmerie Hospital at Brussels, "Three hundred men were collected in this hospital, the majority desperately, not to say incurably wounded. Among them were 140 compound fractures, viz., 86 of the thigh, 48 of the leg, and 6 of the arm. They had been collected all over the country by the peasantry, and dragged from barn to barn, often without food or dressings, and did not arrive until various periods from the eighth to the thirteenth day after they were wounded." Charles Bell, the Edinburgh surgeon,[2] who worked twelve hours a day for the first three days of his visit said, "All the decencies of performing surgical operations were soon neglected. While I amputated one man's thigh, there lay at one time thirteen all beseeching to be taken next. It was strange to feel my clothes stiff with blood and my arms powerless with the exertion of using my knife."

A visitor to Quatre Bras noted in his journal on July 25,[3] "Coming from Waterloo passed 40 wagons of wounded crying out. The men had been in cottages and not able to be removed before. Many died instantaneously, others were in a putrid state—a kind of living death." The

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[1] "Observations on some important points in Military Surgery."

[2] "Life of Sir Charles Bell." A. Pichot, 1860.

[3] "An account of the Battle of Waterloo." Glasgow, 1816.

previous week he had visited the Brussels hospitals where he "saw at the doors a prodigious amount of females waiting to administer to the wounded. Officers and privates were lying indiscriminately, but very clean, females of rank attending with surprising zeal . . . they all had port wine and strong soups." James Simpson the advocate who landed at Antwerp about the same time, noted "a general air of comfort and comparative ease in the accommodation, clothing, and appearance of the men."

It was some months before the general hospitals could be cleared to England. At Antwerp there was a good deal of intermittent fever and an outbreak of typhus. The worst of the surgical cases were sent to the York Hospital, Chelsea, situated in Eaton Square, where Guthrie had charge of two wards. Here he disarticulated the leg at the hip joint, an operation he performed without previous ligature of the artery, and was the first to remove a bullet from the bladder. There was also a large general hospital at Colchester of which James Forbes, McGrigor's late staff officer in Portugal, was in charge.

A hospital return dated April 10, 1816, showed: Wounded, by amputation, 236; discharged, 506; to veteran battalions, 167; rejoined, 5,068; remaining in hospital, 854. Total, 6,831.

When Paris was occupied on July 7, a general hospital was opened at S. Denis. During the three years of occupation the troops were centred round Cambrai, S. Pol, and Valenciennes, being medically treated mainly in regimental hospitals. A new system of dieting was introduced by which the surgeons indented on the commissariat for provisions. The expense was found much in excess of the regulation stoppage of 9d. a day. The commissaries complained that the medical officers insisted on the best of everything, including port wine at 6 francs a bottle and tea at 10 francs a pound.

MEDICAL STAFF PRESENT AT WATERLOO.[1]

Inspector of Hospitals, James Robert Grant, M.D.; *Deputy Inspectors*, William Taylor, John Gunning, Stephen Woolriche, John R. Hume; *Physician*, George Denecke, M.D.; *Surgeons*, David Brownrigg, Henry Gresley Emery, M.D., Thomas Draper, M. A. Burmeister, Robert Grant, John Maling, John Callander, Andrew Halliday, James Matthews, M.D., J. Gideon Van Millingen, M.D., Samuel Berwick Bruce; *Assistant Surgeons*, J. McAuley, William Twining, James Dease, George Evers; *Apothecary*, William Lyons.

Regimental Surgeons.

1*st Life Guards*, *A.SS.* Richard Gough, John Haddy James; 2*nd Life Guards*, *S.* Samuel Broughton, *A.S.* Thos. Drinkwater; *Royal Horse Guards*,

[1] Extracted from C. Dalton's "Waterloo Roll," 1904.

S. David Slow; *King's Dragoon Guards.*, *S.* John Going, *A.SS.* Wm. McAuley, Robt. Pearson; *Royal Dragoons*, *S.* G. Steed, *A.S.* Thomas Prosser; *2nd Dragoons*, *S.* Robt. Dann, M.D., *A.S.* Jas. Alexander; *6th Dragoons*, *S.* John Bolton, *A.S.* William H. Ricketts; *7th Hussars*, *S.* David Irwin, *A.SS.* Robt. Alex. Chermside, Jas. Moffat; *10th Hussars*, *A.S.* George Samuel Jenks; *11th Light Dragoons*, *S.* James O'Malley, *A.S.* Henry Steele; *12th Light Dragoons*, *S.* Benjamin Robinson, *A.S.* John G. Smith; *13th Light Dragoons*, *S.* Thos. Galbraith Logan, *A.S.* Abraham Armstrong; *15th Hussars*, *S.* Thos. Cartan, *A.SS.* Samuel Jeyes, Wm. Gibney; *16th Light Dragoons*, *S.* Isaac Robinson, *A.SS.* John M'Gr. Mallock, Dennis Murray; *18th Light Dragoons*, *S.* Wm. Chambers, *A.S.* John Quincey; *23rd Light Dragoons*, *S.* Samuel L. Steele, *A.S.* H. Cowen; *1st Guards*, *SS.* Wm. Curtis, Samuel William Watson, *A.SS.* John Harrison, Andrew Armstrong, John Gardner, Fred. Gilder; *Coldstream Guards*, *S.* William Whymper, *A.SS.* Geo. Smith, Wm. Hunter; *3rd Guards*, *S.* Samuel Good, *A.SS.* J. R. Warde, Francis Gashry Hanrott; *1st Foot*, *S.* Wm. Galliers, *A.SS.* Wm. Finnie, Thos. Bolton; *4th Foot*, *S.* Francis Burton, *A.S.* Wm. Morragh; *14th Foot*, *A.SS.* Alexander Shannon, Henry Terry; *23rd Foot*, *S.* John Dunn, *A.SS.* Thos. Smith, John Williams, John Monro; *27th Foot*, *A.SS.* Gerald Fitzgerald, Thos. Mostyn; *28th Foot*, *A.S.* Patrick H. Lavens; *30th Foot*, *S.* J. G. Elkington, *A.SS.* John Evans, Patrick Clarke; *32nd Foot*, *S.* Wm. Buchanan, *A.SS.* Rynd Lawder, Hugh M'Clintoch; *33rd Foot*, *S.* Robert Leaver, *A.SS.* Wm. D. Fry, D. Finlayson; *40th Foot*, *S.* William Jones, *A.SS.* Wm. Barry, Geo. Scott; *42nd Foot*, *S.* Swinton McLeod, *A.SS.* Donald Macpherson, John Stewart; *44th Foot*, *S.* Oliver Halpin, *A,SS.* John Collins, Wm. Newton; *51st Foot*, *S.* Richd. Webster, *A.SS.* John F. Clarke, Percy Fitzpatrick; *52nd Foot*, *S.* J. B. Gibson, *A.SS.* Pryce Jones, Wm. Macartney, Thos. Brisbane; *69th Foot*, *S.* Clement Banks, *A.S.* John Bartlett; *71st Foot*. *S.* Arthur Stewart, *A.SS.* John Winterscale, Samuel Hill; *73rd Foot*, *S.* Duncan Dearmid, *A.SS.* John Riach, Fred B. White; *79th Foot*, *S.* Geo. Ridesdale, *A.SS.* Wm. G. Burrell, David Preston; *92nd Foot*, *S.* Geo. Hicks, *A.S.* John Stewart (w); *1/95th Foot*, *S.* Jos. Burke, *A.SS.* Jas. Robson, Robt. Heyt; *2/95th Foot*, *S.* Francis Scott, *A.SS.* John Armstrong, Robert Scott; *3/95th Foot*, *A.S.* Thos. P. McCabe; *Royal Wagon Train*, *S.* Thos. Wynne.

Ordnance Medical Department.

Surgeons, Edward Simpson, T. Macmillan Fogo, M.D., John Morgan, James Powell; *Assistant Surgeons*, Richard Hichins, James Ambrose, Alexander Macdonald, M.D.; *2nd Assistant Surgeons*, Matthias Kenny, Edward Rudge, Thomas Beard, Henry Gatty, Edward Donovan Verner, Henry Peter Loedel, William Barker Daniel, John Bingham, Walter Raleigh, M.D., Stewart Chisholm.

Travel.

PEREGRINATIONS AND PASSPORTS.

By Colonel C. D. MYLES, O.B.E.

(*Continued from vol. lix, page* 459.)

The journey was now at its tiresome period. One sat up and down and sideways, took a little walk in the corridor, jumped out of the train the moment it stopped. Some walked about in close proximity to the train. It was quite unsafe to go more than twenty yards away from your carriage, as very little notice of starting was given. Two or three times a day there might be a stop of eight minutes, and even then one had to be wary.

Reading was difficult owing to the roughness of the permanent way and bad driving. One's neck felt like cracking, or taking a kink. Talking in a train is never very enjoyable and there was not much to talk about. A good deal of time was occupied in raking out food, and packing it up again. Now our white bread began to take on a crystalline form. I tried the Russian black bread but after a few meals began to dread it. We had plenty of food in our grub basket, but nevertheless tried the Restaurant Car. These cars lay in stores on the outward journey at Moscow, and on the return trip have little to offer. It is not given to all to enjoy a beef strogonoff at breakfast, and I am, alas, one of those who cannot do so. A huge slab of tough beefsteak is no good to one at 8 am., and the egg was not available. Another difficulty was the people who ate with you. These trains now carry local passengers. Well, I suppose there is no use blaming a man for not having a bath in Siberia. Firstly it would take a long while getting his clothes off, and in many cases once off I doubt if ever they would go on again; and then, is there such a thing as a bath in the desolate land?—but that is not all. Table manners count for something, but when you have lived all your life in a wooden shack in the wilderness, what criterion have you as to manners?

Quite a number of our fellow-travellers in the restaurant car seemed to push all their food about the cloth, and tackle it there. The result was that the table linen was the worse for wear unless you got in early.

After a few trials we gave up the restaurant car as it was not a necessity. This led us into unforeseen difficulties later on, and as a matter of fact, all the other passengers fell into the same trap.

In contrast to the car was our own compartment which was kept scrupulously clean always and at all times.

Cigarette ash allowed to fall was immediately brushed up by the provfnick (car attendant). These fellows, if a bit surly and mysteriously

uncouth, did their job as regards keeping their coaches clean in a most efficient manner. Of course, being a Wagon-lit, we had our own wash-basins, but the common lavatories at the end of the coaches were spotless at all times, and were washed out at every halt of over five minutes duration, by women who came along with brushes, buckets, soap and cleaning materials.

Our fellow passengers were of varied nationalities, some Chinese and Japanese, male and female, an English Professor and his wife, a German and a Dane. There was another who spoke many languages, so many and so well that I began to suspect him when he evinced a liking for my society. There was also a young fresh English girl, who wanted to get home quickly and cheaply from Japan and so went third class (hard). "Hard" means a peculiar type of bed that can only be slept in when you have developed bursæ on the prominent bony portions of your anatomy. She took a ticket on her lonesome and was not a member of a party, and was much amazed to find herself co-partner with three Russian youths in a four-berthed sleeping compartment. She was scared to death at first, for having done some work in the journalistic line, she knew a good deal about the relations between man and woman obtaining under the Soviet régime. However, the Russians were in no way upset, and considered the situation as normal. I cannot say how they managed, but she seemed to think it was all right. It is, however, worth remembering that if you take one ticket on a Russian railway line, it only entitles you to one berth, and you may have a woman thrust in on you any moment, and vice versa, so when in search of adventures, you now know where to get a certain variety.

Soon we began to notice extremely long trains consisting of about ninety trucks of the "Hommes 20, Chevaux 10" types so familiar to the British soldier. There was a fur-covered soldier in a small open compartment of each. A stove pipe came out of the centre of the roof. Two openings high up with iron gratings were on each side. There seemed to be a partition in the centre and the doors were padlocked. Faces appeared at the gratings, men and women of the peasant class as far as one could judge, but they were well wrapped up. On arriving at certain stations these trains pulled up. Thirty or forty young men were marshalled and provided with two buckets each. They were then marched off under armed escort to the Kapitok when they drew hot water and distributed it along the line. No one took the slightest interest in these trains. In fact people seemed to avoid going near them. The doors were never opened and if put into a siding the train was taken as far away as possible. One presumed they were undesirables following the traditional path of those whom the Russian Government don't want in Russia and despatch to Siberia. Literature informs me that early spring is the accepted time for such moves. Sympathy, of course, one had with them, but judging by the average peasant shack one saw along the line from time to time, they could not be considered badly housed.

They certainly had fires and seemed to have plenty to eat and no evidence of any harshness towards them was noticed at any time. We passed about two of these trains per diem whilst in Siberia. Again at most stations there were great dumps of agricultural machinery of a very modern type. Ploughs, tractors, reapers, winnowing machinery, &c. They seemed to be of American origin. At other times we came across immense dumps of wood, in the form of small logs, large tree trunks and cut planks.

The Russian wagon was everywhere in evidence. A most serviceable article. It consists of a fore carriage connected up with the back wheels by a long pole or a short one as the necessity of the load entailed. On this frame were fitted various types of superstructure, sometimes a large basket, sometimes a crate. At times the rear portion was unhitched and a container put on the front portion only. It seemed to be able to traverse any type of country and if it stuck the load was easily taken off and the cart carried in sections to the next good bit of surface.

On and on we bumped and the seventh day brought us to the Ural Mountains. Alas, we crossed these during the night but they seemed to have a lot of camps all along this section. Evidence of railway constructional activity was apparent in many places. The snow was still everywhere and we passed through some fine forests. The Urals do not appear to be much higher than the Vosges in France.

We passed along several large rivers and they were all frozen. The cold was not so severe as in Siberia. The snow was deeper and looked softer. As it fell the flakes were large and fluffy, compared with the fine flakes in Siberia. The landscape was monotonous, and mostly void of human beings. Towns passed had very little to interest us except occasionally we saw fine examples of the Orthodox Russian Church. The large piles of masonry, with multiple domes, shaped like seed onions, surmounted by crosses of various designs, were very striking.

We crossed the Volga by a very large bridge. The river was frozen solid, and to our surprise there on the right bank was a very up-to-date town. Large modern factories and in the vicinity of each the most modern and up-to-date rows of fine flats of very fine design. It turned out to be Jara-slav.

Next day about lunch time we arrived at Moscow, at the Severnii Station. Here we had a wait of six hours, and whilst our coach was being taken around to the Smolenski Station, we were free to go and see the sights. There was no one from whom we could get any information as how to proceed. The droskys looked quite unsafe and motor cars or taxis did not seem to be available. One had to be careful as there are at least eleven railway station termini at Moscow. At last we persuaded a motor driver to take us to the Grand Hotel, and here we were lucky enough to find one of the hotel staff who spoke a little English and German.

We first went to the Red Square which is situated between the Kremlin

and the old Chinese Merchants' quarters. It contains Lenin's Tomb. This had an armed guard over it. It is a very simple flat-looking tomb. Red porphyry and black marble are the stones used, and it lies adjacent to one wall of the Kremlin. At its right side are a series of marble hurdles arranged after the manner of a racecourse stand. On the tops of the buildings on opposite sides of the square were a large number of searchlights arranged in groups similar to the flood-lighting system adopted recently in London.

Red Square was clean and very little snow was visible. A very beautiful church with azure blue domes and many ornate crosses at one end of Red Square looked very dilapidated, and its immediate surroundings were extremely dirty and unkempt. We passed through Red Square to walk around the Kremlin, admission being barred and all approaches heavily patrolled by armed guards. Once we got out of the Square the going became very bad. The pavement consisting of large blocks of stones, irregular, loose or missing. Trams came up and down, swaying, rattling and clanging bells. We got down to the river. The road by the river was extremely dirty, in a very bad state of repair and littered with debris; the river itself was frozen and dirt was lying everywhere. It took about three-quarters of an hour to pick one's way around the Kremlin. The surrounding wall, about thirty feet high, was in good repair. With it in the foreground and the Palace and several very ornate churches behind, a very beautiful and imposing picture was formed. In the vicinity of the Grand Hotel there are some very fine open spaces which contain huge monuments—very impressive. The snow lying about, the bad pavement and the unkempt look of everything ruined what might have been a very imposing sight, and rendered it most depressing. The houses bordering the streets were in very bad repair and dilapidated. The people in the streets were suitably clad, in that they seemed to have on great quantities of clothing of part-worn type. Everyone seemed to be wearing second-hand clothing. Perhaps the well-to-do people were inside their own houses; but the day, if cold, was dry, and there was a certain amount of sun to be seen. Most of the shops were shut. Those that were open were more of the nature of backwood stores than emporiums of a great capital city. A number of food shops were open and seemed to be fairly busy, but we did not see any queues. There were surprises, however, as every now and then the universal dilapidation was broken by a huge new building of ultra-modern style built of ferro-concrete. These towered up into the sky and were served by great swinging doors and expansive windows in iron frames.

We left Moscow by the Smolenski Station at 9 p.m., and at the terminus surprise came our way when we saw a very efficient and well-equipped series of electric trains rush in and out of the station on a typical suburban time-table schedule.

We arrived at Necoreloge about noon next day. Here we left the Russian

train and proceeded to the examination room. All doors were locked when we got in. There were a number of soldiers placed all around the room. They were all armed and had fixed bayonets. When the baggage was examined and all written and printed matter gone through with precision, our money was checked up. Those they had any doubt about were taken away under a guard and searched. We were then informed that unless we had spent on the average 7·50 roubles per diem on our maintenance whilst in Russian territory, we had now to pay up the difference.

Well I thought I had been through all the snags with Cook and Son. I knew that the regulation was in force in regard to a prolonged stay in Russia, but was told it was not in force on individuals in transit. My share came to 120.00 roubles, about 62·00 gold dollars, or, say, £12. There was, of course, a clear ground for argument, as each passenger put his case in detail and fought about each kopeck. Several times matters became so heated that I expected to see some shooting done. Everyone was careering around the room with little bits of paper full of figures. They understood German in a way, so we were able to make them understand what we thought about them. We could see the Russian boundary out of the window, but that was not much use. I parted with my donation piecemeal, as did most people with a fresh lot of calculations in between. We all felt that if we gave readily more would be demanded. I eventually saved one 10·00 gold dollar note in the confusion. When they had fleeced us they let us depart, but they showed signs of wear, and I think we convinced a few of them that they were plundering the honest wayfarer.

Now we got into a train that made us dizzy after the lumbering Trans-Siberian Express. Poland fizzed by. What we saw of it was flat, muddy and dreary. We had no change until Berlin was reached, so we went to bed about 9.30 p.m. after a nice dinner. At 11 p.m. we were roused and informed that we would have to change our carriage at Warsaw in half an hour as something in the coach was on fire or broken. Trouble seemed to be pursuing us. We made a very uncomfortable change and arrived next morning at the German frontier at 6 o'clock. No snow visible at last. A bright cheery sun, a nice cup of tea, and a beautifully clean restaurant at Neu Bentschen made us feel we had at last reached civilization. At 8 a.m. we arrived at Berlin, and thoroughly enjoyed a four-hour stroll around its well kept and orderly thoroughfares. At 2.30 p.m. we were off again, and after a very calm crossing landed at Harwich just as a snowstorm broke at 6 a.m. We arrived at Liverpool Street Station at 8 a.m., the thirteenth day after setting out from Peking.

It was nearly five years since I embarked for a tour of duty in Ceylon. Every moment was enjoyed whilst at home, and in order to prolong my stay in the United Kingdom to the limit I resolved to go back the same way.

The way I spent my leave is, as they say, another story, but in general I had an extensive motor tour round Ireland where, in spite of the I.R.A.,

everyone was cheerful, most obliging, and only too anxious to see that you were always pleased and had no wants. The same feelings were expressed North, South, East and West. A trip through England and Wales was likewise much appreciated. After that some golf on the delightful links of the Woodbridge (Suffolk) Golf Club. I thoroughly enjoyed the Corps Dinner and the Annual R.A.M.C. Golf Meeting.

A good leave despite the fact that I think the total number of fine days seen was twenty-five.

Everything has an end and when we had seen the National Government installed we stepped into the Harwich boat special at 7.30 p.m. on September 19, 1931. In addition to the usual voluminous tickets, we had in our possession two books of food coupons for the Trans-Siberian Section. There was a guarantee of sorts that, if these were procured, special consideration would be given to holders. This Messrs. Cook and Son told us was the result of negotiations following numerous complaints about extortion.

At 8 p.m. when everything was checked up I bought an evening paper and it gave me the shock of my life. The headline was: "MUKDEN CAPTURED BY THE JAPANESE." Five minutes to make a decision that meant a lot either way. "To be or not to be" and the starting gate going up. I thought, Saturday 8 p.m. No use telephoning to the War Office. To add to my worry Cook's had not procured a Japanese visa for me, saying, "You are not going near Japanese territory." I knew that, of course, but it only cost two shillings and I thought I might as well have it now, there was no doubt I would require it taking the mildest view of matters. Well we decided to carry on and said a last farewell to our friends and steamed out.

Arrived in Berlin 8 p.m.; no chance to get that visa. On the same night we went on to Tilsit as we were entering Russia by Daugovpils and Bigosovo.

We picked up the Russian train at the latter station, went through the Customs and cross-examination and arrived Moscow 2 p.m. next day.

Here to our amazement we were met by an official of the In-Tourist Bureau. He actually had a bus to take us into the office near the Kremlin. We had six hours to wait so we strolled at leisure. The scene that met our eyes was a transformation. The streets were quite clean and all the broken patches in the roads around that section of the city repaired. Street after street had great rows of scaffolding up on which were numbers of workmen colour-washing and effecting repairs. The old dilapidated shops had been or were being provided with good fronts and were being stocked with modern articles. These newly opened shops drew small crowds looking at the fine unusual display. Officials were dashing in and out, for of course all the shops were under the control of the Central Government not private enterprise.

We were told we might have a pass to enter the Kremlin from 7.30 to 9 p.m., but as we were due to depart at 8 p.m. we could not avail ourselves of this opportunity.

Great stores were being opened up in the Chinese City as they call it, and everywhere activity in cleaning, repairing and developing resources.

It was a complete transformation from that seen on our last visit four and a half months previously. Of course we had read of the Five Year Plan and here was direct evidence that action was being taken. The ornate churches which in April showed more than signs of mere neglect were being cleaned and touched up. They are now, we were informed, used as Government offices, schools, etc. There is a school for English-speaking children and also one for Germans in Moscow.

We returned to the In-Tourist Office and were met by the same official. He had the motor car ready for us, and on the way back to Severnii Station he pointed out the new offices of the Clothing Department. An immense building which looked as if it were made of glass on account of the very expansive windows, ultra-modern in design and architecture. On the opposite side of the street was a large area cleared for the erection of the Agricultural Department. *En passant* to show how traffic is controlled. On our way the chauffeur disregarded a traffic signal and fouled a tram. There were a few mutual recriminations and we passed on, but before we could get going a man in mufti stepped on to the footboard and ordered the chauffeur to pull up. On the chauffeur asking this boarder who he was the latter pulled back his coat, left side, and displayed a large silver badge. On seeing this the chauffeur pulled out of the traffic at once and paid a fine of one rouble for which he got a receipt. The way this traffic man behaved and the method he adapted of disclosing his identity reminded me of a personal encounter in Spain in 1926 with a secret policeman.

The In-Tourist Officer saw us back to the train and literally invited us to make suggestions and requests and introduced a man he called the train interpreter. An innovation in the form of a repatriated Russian from America. (Repatriation is quite a new idea under the Soviet apparently.)

Having a legitimate grievance to air I demanded what they meant by forcing us to hand over money for nothing at Nigoreloje in April and if I might expect a similar demand on leaving at Manchuria. I was informed that the authorities were now of opinion that such action on their part was not completely justified. I suspected this reply was a placebo for hurt feelings. That in my case I was in possession of a set of food coupons and there was no possibility of it happening, and in other cases they did not intend to press the rule in future. Further, he pointed out that he was sure I would notice an improvement in the general management of the restaurant car (in this he was correct), and if I wished to wait two days for the Traine-de-Luxe I would travel in a train from which local inter-station passengers were excluded.

A table was practically reserved for us in the restaurant car. We were able to get white bread for five days out of seven. The table linen was fairly clean. Meals were served at regular hours. The pot of soupa they began the midday dinner with was excellent, and eggs were always to be

had on demand. I may have been suffering from delusions, but the rougher elements of the inter-passenger traffic seemed to be allotted tables a good way off from ours. All this, however, may have been due to the fact that we were the only English passengers on the train, and they were out to correct a bad impression. The interpreter was always to hand when I sent for him, but of course in this respect one had to be wary, and I have no doubt that, if he gave information he was also gleaning. We asked the In-Tourist official if he knew anything about conditions in Mukden and Manchuria in general, but he was unable to tell us any more than we already knew.

We left Moscow punctually at 6 p.m. Next day we came to Viatka, and the day after to Sverlovsk. All along the line of route, and especially at these two large towns, there was great activity in the building line. Great wooden houses were being erected, sites being cleared for more, and full corroboration was given of the account of the Five Year Plan described in the "Five day weekly for English-speaking Workers of the Soviet Union," i.e., *The Workers News*, price five kopecks. At Sverlovsk we met the home-coming Siberian express. There were some Englishmen on board. They had come from Vladivostok, but said they thought trains were running through Manchuria. We were now in Siberia. The days were warm, but nights quite chilly. Autumn tints were in full evidence, and the silver birch forests were an amazing mass of golden blaze, especially at sunrise and sunset. Most of the crops were gathered in. Everywhere buildings were being put up. New sidings arranged, bridges being widened and tractors were to be seen everywhere ploughing up new areas.

We passed through Omsk on September 25 and reached Krasnoyarsk on the 26th, and now began to rise into the mountainous regions of West Siberia. We reached Irkutsk 10 p.m. September 27, and passed Lake Baikal on a perfect moonlit night. This time, of course, it was free from ice. No boats were visible on its surface. A truly wonderful expanse of water. Next morning our journey lay through mountainous country along the banks of big rivers and through fertile valleys. Great lumber camps were visible on all the rivers, and every valley had a large village.

The following day we were in more open country and passed through Verchnyeudinsk. Here there were many soldiers to be seen, and what was obviously a large barracks. We were now approaching the Mongolian-Manchurian-Russian frontier. We passed Chita once more; it is an old town, but it is still what can only be classed as a collection of log cabins. Streets as we call them don't appear to exist, but I suppose there is no great necessity for them as for six or eight months the ground is ice and the remainder of the year they are dry and hard. Still it shows how little satisfies people in these parts. At Karyimskaya we left the main Trans-Siberian line and headed south-east to Manchouli, the terminus of our Russian journey.

Through Siberia we posted letters at Omsk and Irkutsk. They got

home all right, but went via New York and so took some time. Letters posted at Manchouli don't appear to have arrived yet. At Manchouli we changed to the Chinese Eastern Railway. Passports, customs and money changing gave us a busy hour, but there were no unpleasant incidents.

There was no news to be had concerning conditions in lower Manchuria. We changed at Harbin. Here we were told that trains were now running through to Dairen. No news re Mukden—Peking route. "One telegram had been received in Harbin yesterday from Europe. The first in ten days." On the Chinese Eastern Railway there is a double staff. For every Chinese there is a Russian official, and tickets and passports are examined by a small procession similar to what goes round one of our Troopers at 10.30 a.m., daily. The restaurant car is very good and has likewise a double staff.

We reached Chang Chung at 4 p.m., September 30, 1931. There is a combined station ; one half Chinese, the other Japanese. Here we came into war conditions with a jump. No Chinese were visible. The station was sandbagged and guarded at every possible point by Japanese infantry in full fighting kit down to steel helmets. As there were notices in the station warning all and sundry not to approach Japanese territory without a passport I tried to obtain a Japanese visa, but could not manage it. This seemed very necessary as failing transit via Mukden and Peking we must proceed to Dairen.

As soon as the Trans-Siberian mails were transhipped we were off. Just outside Chang Chung we came across an aerodrome compound of about thirty to forty Chinese aeroplanes in possession of Japanese soldiery. The line was guarded all the way by Japanese sentries. The whole country as far as one could see on either side of the line was one great mass of standing crops of considerable variety and in excellent condition. Here and there small parties were at work on the crops, but we could not definitely locate a Chinaman all the way down. The usual crowds present in stations along the line were absent, only sandbags and Japanese infantry being visible.

We arrived at Mukden at 10.30 p.m. I jumped out and found the Yumati Hotel porter who acts as Cook's agent. He advised me to go on to Dairen as the possibilities of a train to Peking were nebulous. I had just time to jump back into the train and did not dare to go near the booking office for fear of being asked to produce my passport. I rang for the train attendant and told him I wanted a sleeper and to pay for my ticket Mukden—Dairen. This was arranged without difficulty, but at 11.30 p.m. an official came along and demanded our passports. I gave him what I had with a bow and a smile and hoped for the best. He retained these until next morning and returned them with a nice bow and no remark and a great load of anxiety was lifted. They were evidently taking the case on its merits and were not going to make trouble.

We arrived at Dairen at 8 a.m. on October 1, to find a boat had just

departed to Tientsin and that there was another sailing next day. This I was informed was full, and I should have to wait eight more days for a passage. Very depressing information, but, nothing daunted, I pitched my camp on the counter of the Hotel Shipping Office and after one hour the Japanese lady clerk arrived. I gave her my best smile and bow, explained the situation and expressed a hope that knowing her to be the giver of all good things she would allot me a passage on the deck of the boat going next day. She made several essays on the telephone with the Shipping Office, but always came back and said a passage to Tientsin by that boat could not be obtained. I persisted, however, and finally she said the manager would like to see me personally at his office. A rickshaw was procured and off we dashed. At the shipping office we found eight people looking for a passage on that boat. I sent in my card to the Manager, who came out and informed the others that he must settle with me first. After much talk we eventually secured two first-class passages but I was informed there was only deck space. To this we readily agreed. Feeling much easier we went back to the Grand Hotel.

I went to change a few English notes I had and to my sorrow was handed back for £7, Yen 51.50 in exchange; I expected Yen 70.00. Argument disclosed to us the fact that England had just gone off the Gold Standard and the £ was very much down. That was the first bit of news we had of England since September 19. A truly horrid shock, a very unpleasant fact to assimilate, and following the example of St. Paul we quickly gave up "kicking against the pricks."

Being in Dairen it was imperative that one should see Port Arthur, so we engaged a car and after a very fair lunch in the Japanese Grill Rooms where everything is done so well and effectively in Japanese fashion, we proceeded to Port Arthur. The story of its siege and capture is an old one now, but a look at the positions stormed and forts taken by assault confirmed the wonderful impression formed on reading of it all long ago, and one was still left marvelling how such a position was taken by direct assault almost straight away.

The next day we embarked at 7 a.m., and were informed by the Captain of the boat that our names were not on the passenger list. We knew that information was coming, for Japanese regulations do not permit of deck passengers apparently. I was at a loss how to proceed when I found the manager along side of me and he explained the position to the Captain's satisfaction.

The boat "Tencho Maru" was crowded chiefly by Chinese making for home. All meals in the first-class saloon were served at three sittings on that boat. The food was excellent, the cooking and serving, in spite of the crush, were first class. The sea was calm, the night not too cold, and we were provided with long wicker chairs and plenty of blankets and pillows. Next morning we steamed up the Pei-ho, and reached Tientsin at 10 o'clock. The "Tencho Maru" was the only boat to venture up the river,

as owing to labour troubles and lack of summer rains the river was silting up and the dredgers could not compete with it successfully. Anyway, the deed was accomplished, and I had arrived within the confines of the China Command before my leave had expired.

A quick tour of Tientsin and Peking on inspection duty. Two days spent on the mud of Taku Bar (mouth of the Pei-ho), fourteen days in Shanghai, during which time four Majors R.A.M.C. successfully negotiated (h) (v), and then we were back to the hustle of Hong Kong.

This ends the narrative, and I hope, if it falls into the hands of any Russian official, he will not form the opinion that I entered his country with any idea of espionage in my mind.

When stationed in the Far East the route via Siberia is the best and has very many advantages, and if circumstances permit I intend to avail myself of it again.

Current Literature.

Burn, J. H. **Aluminium and Food.** Research Reports of the British Non-ferrous Metals Research Association.

The author states there is nothing absurd in the suggestion that the daily consumption of traces of chemical substances in food may be harmful. It is no argument that since aluminium cooking vessels have been in use for many years without any obvious ill-effects, it follows that they are harmless. The only way to arrive at a sound conclusion is to apply the experimental method. The rat, rabbit and especially the dog may be used for these experiments, as the digestive processes in these animals have much in common with those in man, and what is true of these animals is also true of man. In 1893, when the Prussian War Office was considering the employment of aluminium for soldiers' water bottles and cooking utensils, researches were undertaken by Plagge and Lebbin, who fed rabbits with a solution of sodium aluminium tartrate added to milk for periods varying from seventeen days to two and a half months. The amounts of aluminium varied from 1·5 up to 6 grains daily, which corresponded to doses of 45 to 180 grains in a man of ten stone. The ordinary growth of the rabbits was not affected. They remained in perfect health and gained in weight.

In 1914 doubts had arisen in the United States as to the safety of using baking powder containing twenty-five per cent calcined sodium aluminium sulphate. Experiments were carried out on young men by Dr. Chittenden of Yale, Dr. Taylor of Pennsylvania and Dr. Long of Chicago.

Dr. Chittenden fed his men on bread made with alum baking powder; the amount of alum consumed per man per day began with 8·9 grains (aluminium, 1 grain), which was increased to 35 grains (aluminium, 3·96

grains) at the close of the dosage period of 130 days. Dr. Chittenden concluded from his investigations that small quantities of aluminium compounds and even comparatively large quantities when taken with food had no effect on the general health or nutrition of the body. Drs. Long and Taylor, who used alum and the residues from baking powder for their experiments, arrived at similar conclusions. The Board which reported on the work of the three investigators stated that the amount of aluminium (2·3 grains) ordinarily consumed in the form of baking powders did not render the food injurious to health. Large quantities of baking powder (up to 3 grains of aluminium daily) might produce mild catharsis due to the sodium sulphate which results from the reaction. "Alum baking powders were not more harmful than any other baking powders, but it would be wise to be moderate in the use of foods which are leavened with baking powder."

There is not much evidence as to the amount of aluminium which enters foods cooked in aluminium utensils. The most useful investigation is that of Massatch, published in 1929. He found the following quantities of Al_2O_3 for each person consuming these foods: scrambled eggs and bacon, 0·06 milligramme; cocoa, 0·6 milligramme; cabbage, 5·5 milligrammes; goulash, 0·25 milligramme; bouillon with beef, 0·45 milligramme; cakes, 0·3 milligramme; apple sauce, 6·0 milligrammes. This is a daily amount of $\frac{1}{5}$ grain of Al_2O_3, most of which comes from the cabbage cooked with vinegar and from the apple sauce.

Steudel supervised experiments in which the residue obtained by boiling successive quantities of Berlin tap-water for many weeks in an aluminium pan was added to the diet of rats. Each rat received 0·1 of the residue (about $\frac{1}{10}$ grain of alumina) daily for about four months. All the rats remained quite well and were indistinguishable from control rats.

Dr. Burn concludes his paper with the statement: "Aluminium cooking vessels offer no danger to health. When aluminium salts are taken by the mouth, small quantities are absorbed into the blood and tissues; it is, however, a peculiarity of aluminium salts that, except when introduced into the body by injection, they produce no harmful effects. When aluminium cooking vessels are used, the amount of aluminium salts which enters the food is not more than a small fraction of a grain a day, and of this only traces are absorbed into the tissues; these have been repeatedly shown to be harmless."

SMITH, J. **The Serological Diagnosis of Typhoid and Paratyphoid Fevers.** *Journ. Hygiene.* 1932, v. 32, 143-55. [22 refs.]

The author records a series of observations on the occurrence of H and O agglutinins in typhoid and paratyphoid B infections. The majority of the cases were examined once only, and the day of disease on which the examination was made varied somewhat widely, a few cases being examined as early as the second or third day of illness. In some cases the test was

repeated at a later date; usually during convalescence. The fluctuations observed were of the kind that would be expected.

In 19 of the 28 cases of typhoid fever, and in 24 of the 42 cases of paratyphoid B fever, the diagnosis was confirmed by the isolation of the causative organism from the blood, urine or fæces. In the remaining cases—in many of which an adequate bacteriological examinatiom was impossible—a history of actual contact with a diagnosed case, or the epidemic happenings at the time, left no reasonable doubt as to the nature of the infection.

The results of the first agglutination test in each case were as follows. Of 28 cases of typhoid fever, 24 showed the presence of H agglutinins for *Bact. typhosum* to titres varying from 1 : 25 to 1 : 51,200. (In 3 of the 4 negative cases the blood was taken during the first week of the disease.) Twenty-one cases showed O agglutinins for *Bact. typhosum* to titres varying from 1 : 25 to 1 : 800. Six of the cases that showed H agglutinins showed no O agglutinins at the time they were examined, and three of the cases that showed O agglutinins showed no H agglutinins. Seven cases showed H agglutinins for *Bact. paratyphosum* B as well as for *Bact. typhosum.* The titres for the former organism ranged from 1 : 25 to 1 : 1,600, and in each case the titre for *Bact. typhosum* was higher—usually much higher—than for *Bact. paratyphosum* B. Six of the 28 typhoid cases showed O agglutinins for *Bact. paratyphosum* B to titres varying from 1 : 25 to 1 : 200. (One case was not tested against this organism.) One of these 6 cases showed no O agglutinins for *Bact. typhosum*, in 2 cases the O titres for *Bact. typhosum* and *Bact. paratyphosum* B were identical, in 3 cases the O titre for *Bact. typhosum* was higher than for *Bact. paratyphosum* B.

Of 42 cases of paratyphoid B infection, 41 showed H agglutinins for *Bact. paratyphosum* B to titres varying from 1 : 200 to 1 : 102,400, while 25 showed O agglutinins to titres varying from 1 : 25 to 1 : 800. Sixteen of the cases that showed H agglutinins for *Bact. paratyphosum* B showed no O agglutinins for that organism at the time they were examined. (But 5 of these cases showed O agglutinins for *Bact. typhosum.*) None of the cases that showed O agglutinins for *Bact. paratyphosum* B failed to show H agglutinins for that organism. Fourteen of the 42 cases of paratyphoid B infection showed H agglutinins for *Bact. typhosum* as well as for *Bact. paratyphosum* B. In 2 cases the titre was the same for both organisms; in the other 12 the titre was higher—usually much higher—for *Bact. paratyphosum* B than for *Bact. typhosum.* Twenty of the 42 cases of paratyphoid B infection showed O agglutinins for *Bact. typhosum*; of these 5 showed no O agglutinins for *Bact. paratyphosum* B, 1 gave a higher titre with *Bact. typhosum,* 2 gave the same titre with both organisms, and 12 gave a higher—but usually not much higher—titre with *Bact. paratyphosum* B than with *Bact. typhosum.*

During the course of this investigation samples of serum were taken from 17 persons who had received some form of prophylactic inoculation

against the enterica group between the years 1915 and 1928. All of these showed H agglutinins for *Bact. typhosum* to titres varying from 1 : 25 to 1 : 400. Two showed O agglutinins for *Bact. typhosum* (titres 1 : 50 to 1 : 200). Six showed H agglutinins for *Bact. paratyphosum* B (titres 1 : 50 to 1 : 100). None showed O agglutinins for *Bact. paratyphosum* B.

The author notes that, by employing these methods, no serious difficulty has been encountered in the diagnosis of typhoid and paratyphoid infection. The inclusion of an O suspension of *Bact. typhosum* in the tests is clearly essential, but the inclusion of the O suspension of *Bact. paratyphosum* B appears, on the basis of these results, to be of less value.

The paper includes a detailed account of a few additional cases in which the infecting organism was eventually shown to be some other member of the Salmonella group. In such cases it is, of course, necessary to carry out additional agglutination tests against the appropriate bacterial suspensions.

W. W. C. TOPLEY.

Reprinted from "Bulletin of Hygiene," Vol. 7, No. 9.

GOEBEL, W. F., BABERS, F. H., and AVERY, O. T. **Chemo-Immunological Studies on Conjugated Carbohydrate-Proteins. VI. The Synthesis of *p*-Aminophenol *α*-Glucoside and its Coupling with Protein.** *Journ. Exper. Med.* 1932, v. 55, 761-7.

AVERY, O. T., GOEBEL, W. F., and BABERS, F. H. **VII. Immunological Specificity of Antigens Prepared by Combining *α*- and *β*-Glucosides of Glucose with Proteins.** *Ibid.* 769-80. [10 refs.]

Continuing their studies on the immunological reactions of conjugated carbohydrate-proteins, the authors have synthesized *p*-aminophenol *α*-glucoside and *p*-aminophenol *β*-glucoside, and have coupled these compounds to proteins to form antigenically active complexes. With these it was possible to study the effect on immunological specificity of the known differences in the spatial position of the groups on the first carbon atom of these isomeric glucosides.

The results obtained were of great interest. An anti-*α*-glucoside serum gave precipitation with a linked *α*-glucoside antigen, and this precipitation was specifically inhibited by the addition to the antiserum of the unlinked *α*-glucoside; although, in conformity with all earlier findings, the simple hapten unlinked to protein did not itself yield a precipitin with the antiserum. Similarly, an anti-*β*-glucoside serum gave precipitation with the linked *β*-glucoside antigen, and this precipitation was specifically inhibited by the unlinked *β*-glucoside. The addition of the *α*-glucoside did not inhibit precipitation in a mixture of linked *β*-glucoside antigen and an anti-*β*-glucoside serum, nor did the addition of the *β*-glucoside inhibit precipitation in a mixture of linked *α*-glucoside antigen and anti-*α*-glucoside serum. The change from the *α* to the *β* type of glucoside linkage had thus resulted in the conferment of a definite immunological specificity. When, however,

the anti-α-glucoside serum was tested against the β-glucoside linked antigen, or the anti-β-glucoside serum against the α-glucoside linked antigen, well-marked cross-precipitation occurred. This immunological relationship is, of course, reflected in the chemical structure of the synthetic antigens. There are stereo-chemical differences in the arrangement of the groupings on the first carbon atom, bearing the non-sugar constituent of each glucoside, but in both glucosides the spatial arrangements of the polar groups on the five remaining carbon atoms are identical.

These observations clearly supply a beautiful analogy to the immunological relationships that are found to exist between naturally occurring bacterial antigens and haptens, and the authors discuss this analogy in the particular case of the relationship of the polysaccharide component of the Type II pneumococcus to the polysaccharide component of the Type B Friedländer's bacillus. W. W. C. TOPLEY.

Reprinted from " Bulletin of Hygiene," Vol. 7, No. 9,

DULANEY, A. D., WIKLE, W. T., and TRIGG., R. **H and O Agglutination as an Aid to the Diagnosis of Typhoid Fever.** *Amer. Journ. of Public Health.* 1932, xxii, 1033.

In this study there were tested 41 typhoid patients, 30 patients suffering from non-typhoid febrile diseases and 90 students who had been inoculated with vaccine.

The emulsions used at first in the agglutination tests were an 0·1 formolized antigen prepared by Dreyer's method and an alcoholized antigen prepared by Gardner's method, but later a 1 per cent formolized antigen was used as being better for the detection of H agglutinin than is the 0·1 per cent formolized antigen. The writers consider that the weaker formalin concentration does not entirely inhibit O agglutinins. A macroscopic method of testing agglutination was employed, dilutions of serum from 1 : 20 to 1 : 2,560 being put up and incubated at 52° C. for two hours for H agglutinins and for twenty-four hours for O agglutinins.

They found that in typhoid fever there is high development of H and O agglutinins. In febrile non-typhoid diseases 50 per cent gave H agglutinins varying from a serum dilution of 1 : 40 to 1 : 160, and 23 per cent gave O agglutinins exceeding 1 : 100, but none over 1 : 400.

Of the vaccinated individuals 91 per cent gave H agglutinins from 1 : 40 to 1 : 2,560, and 81 per cent gave O agglutinins at dilutions of 1 : 40 or over, 26 per cent being over 1 : 100, but none up to 1 : 500.

The writers conclude that the relationship of O agglutinins to infection is definite, but that the titres of 1 : 100 and 1 : 200 as suggested by Felix are not high enough, since the 1 : 100 titre was exceeded by 23 per cent of non-typhoid febrile patients, and in 25 per cent of the vaccinated persons. They consider that since 85 per cent of the typhoid patients agglutinated O antigen in serum dilutions of 1 : 500, this dilution might

be arbitrarily accepted as indicative of infection regardless of vaccination history.

They also consider that the ease of preparation of the antigens and their stability recommend H and O agglutination as a laboratory procedure in the diagnosis of typhoid fever, although it could never have the validity of the isolation of the causative organism.

ARMSTRONG, CHARLES. **Post-vaccination Encephalitis.** Public Health Reports, U.S.A., 1932, xlvii, 1554.

In this paper, which is based on the author's Cutter Lecture at Boston, Mass., in March, 1932, the name "Post-vaccination encephalitis" is preferred to "Post-vaccinal encephalitis," since the complication appears after the vaccination and at the height of the vaccinia rather than after it.

About seven hundred cases have been reported since 1924, when the condition came to notice, and of these only seventy-one occurred in the United States. The vaccine lymph used in these American cases came from ten of the twelve vaccine establishments in the country. In one city in 1930, there was a group of five cases, occurring within thirteen days, and the vaccinations were performed by five different physicians. The single type of insertion was used in these cases, as also in all but one of the seventy-one cases.

Two of the American cases are said to have followed a second vaccination. In countries where infant vaccination is common it has been noticed that the complication is rare when vaccination is performed during the first year of life.

Diagnosis, pathology, prognosis and ætiology are discussed briefly.

The paper is mostly concerned with prevention. The author states that it is well established that primary vaccination in infancy and re-vaccination at any age are relatively unlikely to be followed by the complication, and it is known that the reaction is milder in both these groups than in primary vaccination performed after the first year.

The writer states that it has been observed that healthy, plump animals react more severely to vaccination than do the "scrawny" and those suffering from some infection, and that in man the healthy, full-blooded react more than do spare individuals. He has observed that post-vaccination encephalitis and post-vaccinal tetanus are more frequent in healthy children. He then mentions observations in various diseases in which, in man or in animals, an attack of one disease appears to stimulate a defence against other diseases, such as malaria in general paralysis of the insane, and vaccinia in leprosy, also the lower rate of poliomyelitis in Schick-negative than in Schick-positive children.

The author made a series of experiments on white mice in which he used a vaccine virus which was capable of producing a fatal meningo-encephalitis when introduced into the brain of these animals. Two subcutaneous injections of diphtheria toxoid were given, and after varying

periods, usually twenty-one days, the vaccine virus was given by intracerebral injection. In control mice, saline solution was used for the preliminary injections.

The experiments seem to show that there were more survivals among the toxoid immunized animals than in the control group, and that the former tended to die later than the non-immunized animals.

It is shown in a chart of the combined results of five experiments that at twenty days thirty-five per cent of the toxoid animals were alive as against seventeen per cent of the control animals, and at twenty-five days the numbers were twenty-seven and twelve per cent respectively. In animals in which the vaccine virus was injected one day after the toxoid injection there was no protection.

The author does not claim that these results necessarily lead to the conclusion that diphtheria toxoid injections will prevent the occurrence of post-vaccination encephalitis in man but he hopes that they will lead to further investigations.

In a summary the author states that, so far, the only means suggested for the prevention of the complication are concerned with vaccination procedure. A suitable vaccination technique is defined as one employing a small superficial insertion, never over one-eighth of an inch in greatest diameter, and employing no routine dressing. Infancy is the best time for primary vaccination. As a result of his experiments, which suggest that previous inoculation with diphtheria toxoid renders mice somewhat more resistant to vaccine virus, he considers that primary vaccination, especially after the first year of life, should be deferred till immunization against diphtheria or other diseases by means of inanimate antigens has been accomplished.

In a footnote the writer suggests that the first dose of diphtheria toxoid be given to an infant at six months, the second dose one month later, and vaccination against smallpox three to four weeks after the second dose. In the case of older children a similar spacing of injections would be employed.

Dick, George F. and Dick, Gladys H. **Antitoxic Immunity resulting from Administration of Toxin by Mouth.** *Journ. Amer. Med. Assoc.*, 1932, xlviii, 1436.

Individuals were selected who gave no history of scarlet fever and who reacted positively to the Dick test. The toxin used was a sterile scarlet-fever toxin from which the streptococci had been removed by filtration; it was given orally in doses of from 4 cubic centimetres to 16 cubic centimetres once a day on successive days. The toxin contained 50,000 skin-test doses per cubic centimetre, so the doses administered increased from 200,000 to 800,000 skin-test doses.

From twelve to sixteen days after the first dose was given skin tests were performed to estimate the immunity produced. Before, during, and

at the end of the test, nose and throat cultures were made on blood-agar to exclude the possibility of accidental immunization, and any individual showing streptococci on culture was excluded from the test.

The same toxin was used to immunize another group of 209 individuals by the usual method of hypodermic injection, the doses being 500, 2,000, 8,000, 25,000, and 100,000 skin-test doses, injected weekly.

Of 19 individuals who took 8,315,789 skin-test doses by the mouth 73·1 per cent gave a negative skin reaction in from twelve to sixteen days, while of the 209 individuals who received 135,500 skin-test doses by subcutaneous injection 93 per cent became negative.

The authors conclude that ingestion of scarlet-fever toxin may lead to the production of a skin-test reaction, but that the oral method of immunization is less efficient than subcutaneous injection of toxin.

Reviews.

SYNOPSIS OF THE BRITISH PHARMACOPŒIA, 1932. Compiled by H. Wippell Gadd. 12th Edition. London: Baillière, Tindall and Cox. $4\frac{1}{4} \times 2\frac{3}{4}$. Pp. 189. Price 2s. 6d. net.

It is impossible either to memorize or to become familiar all at once with the many changes and alterations which are to be found in the British Pharmacopœia of 1932, and so the appearance of the 12th edition of this already well-known and useful Synopsis is all the more apt and welcome. Included amongst its pages will be found a list of the new drugs and preparations, some 120 in number, an enumeration of 357 articles which were in the British Pharmacopœia of 1914, but are not included in the 1932 issue, articles and preparations whose names have been altered, whose composition has been changed, and those drugs which show a difference in strength of ingredients. In addition, the prescriber will find a list of all chemicals, drugs and preparations contained in the present Pharmacopœia, giving the dosage on both the imperial and metric scales; in the column of remarks many helpful data will be seen. Also, time-saving notes regarding atomic weights, thermometric scales, abbreviations, definitions, weights and measures, etc., will be found under their appropriate headings, and to complete this *vade mecum* some important facts upon the Poison Laws and Dangerous Drugs Act are given. It will be gathered, therefore, that much has been compressed into the 189 pages, but in spite of this the print is exceptionally clear and the type of a size that can be read easily and comfortably.

This Synopsis can be recommended with confidence, and until the new British Pharmacopœia has become familiar to all who are actively engaged in prescribing and dispensing, this little book, which has proved its worth

in the past, now becomes of paramount value as a handy book of reference. Its general utility is enhanced by the fact that it can be carried in the vest pocket, and, as heretofore, it will never be absent from the reviewer's armamentarium.

PHYSICAL CHEMISTRY. By Dr. John Eggert. Translated by S. J. Gregg, Ph.D., A.R.C.Sc. London: Constable and Co. Pp. xi + 632. Price 24s.

The publishers of this work are to be congratulated on the production of a very fine book. The paper and printing are all that can be desired and a careful search has failed to reveal any printing errors. Dr. Gregg should also be congratulated on his translation into beautiful English. One wishes that all writers of books on science would follow his example, and pay a little attention to clear expression and good grammar. The subject matter of the book is very advanced and involves a profound knowledge of mathematics beyond the ken of any scientist other than a physicist, or perhaps a chemist who has deserted his laboratory bench for slide rule and a book of logarithms.

ROUNDABOUT HARLEY STREET. By Cyril Phillips Bryan, M.B., Ch.B. London: John Bale, Sons and Danielsson, Ltd. 1932. Pp. 260. Price 5s. net.

In this volume the author traces the development of the Harley Street area from the days when it was a region of swamps, the haunt of thieves and robbers, down to such a recent medical event as the opening of Manson House, the home of the Royal Society of Tropical Medicine.

Medical men have abounded in this district, the pioneer having been Dr. James Newton, a mental specialist, who was in practice in Cavendish Square in 1720.

Of special interest to readers of this Journal are the notes on the careers of three Army medical officers.

The first is the Rev. Dr. John Trusloe who, by selling sermons to his less capable or lazier clerical brethren, was enabled to study medicine under John Hunter and to obtain the degree of M.D. of Leyden. He then combined the practice of his two professions by becoming doctor and chaplain to the 90th Regiment of Foot.

Dr. "James" Barry, the woman who concealed her sex and attained high rank in the Army Medical Service, and Sir James McGrigor, who holds the record for length of service as Director-General, both lived in the Harley Street area.

"The King of Quacks" flourished in Harley Street about 1829; he was a young Irish basket-maker who, with the help of a lotion and a liniment, earned over ten thousand pounds a year and the carriages of his fashionable patients blocked the street daily.

The tale of the abduction of Sun Yat Sen in 1896 in Portland Place,

his incarceration in the Chinese Embassy there, and the part played by Sir James Cantlie and Sir Patrick Manson, in effecting his release, makes astonishing reading.

The author does not confine his attention to the medical inhabitants of Harley Street and its neighbourhood, and his book can be recommended as an interesting and lively work on a renowned district of London.

FORENSIC MEDICINE. THE CATECHISM SERIES. Third Edition. Revised by Andrew Allison, M.B., Ch.B., B.Sc., D.P.H., F.R.F.P.S.Glas. Edinburgh : E. and S. Livingstone. Pp. 80. Price 1s. 6d. net.

By some people, catechism as a method of teaching or of learning is regarded unfavourably, nevertheless it must be admitted that this little book of the Catechism series will prove to be very useful for reference purposes. More especially will this be realized by members of the Services, whose libraries must be portable, and therefore limited both in bulk and weight. In this Catechism on Forensic Medicine will be found a workable knowledge and a safe guide in respect of some thirty-six important matters connected with the causes of unnatural and violent death, with coroners, courts, medical evidence, insanity and so forth. Unless one is constantly coming into contact with this aspect of medical practice, one's knowledge upon many points of medical jurisprudence is apt to become hazy, and therefore a book of this nature, even though it is in the form of question and answer, becomes a real help. It is impossible to go into further detail, but it can be said with candour that the small monetary outlay is well repaid by the peace of mind which results from the knowledge that such a useful stand-by as this is included in the mobile reference library of a practitioner in the Services.

CHOOSING A WIFE AND OTHER ESSAYS. By E. G. Dru Drury, M.D., B.S.Lond., D.P.H.Dur. Lecturer in Physiology at Rhodes University College, Grahamstown, S. Africa. London : H. K. Lewis and Co., Ltd. 1932. Pp. viii + 276. 8s. 6d. net.

The seventeen essays which the author has collected into book form were originally delivered as addresses to various bodies—Grahamstown students, nurses and medical men of South Africa—and are, to quote from the dedication, attempts to depict the physiology of our emotional life in the vulgar tongue, and some fragments of local history. Wide as is the range of subjects, the essays all bear evidence of the marked literary skill of the author ; the many apposite quotations and references show that Dr. Drury's acquaintance with literature, both scientific and general, is so wide as to rouse our envy and admiration. Besides the essay which gives the title of the book, other addresses are on such subjects as Psycho-analysis, Fidelity and Freedom, an Ear for Music, Depolarizing Words, etc. All are instructive and offer very pleasant reading.

Correspondence.

ANTI-MOSQUITO MEASURES.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—The anti-larval method for the control of mosquito breeding in rifle-range pits and railway and other borrow pits, reported from Sialkot in the current number of the Journal, was one of the measures advised from Northern Army Headquarters, India, in 1927 to 1928, and demonstrated to all cantonment anti-malaria officers in the command.

The description is not complete without the following additions:—

(i) When the natural contours of the ground permit, to facilitate drainage, a protective shallow circumvallate runnel should be carried around the ramp encircling the borrow pit.

(ii) The graded bottom of the borrow pit should be shown as herring-bone drained to the sump.

In large borrow pits, two or more herring-bone channel systems and sumps may be used with advantage.

Headquarters,
Southern Command,
Salisbury.
December 13, 1932.

I am, etc.,
C. H. H. HAROLD.
Major, R.A.M.C.

Notice.

THE INTERNATIONAL HOSPITAL ASSOCIATION.

THE International Hospital Association organized, from the end of September to the beginning of October of 1932, a first series of International Post-Graduate Courses on Hospital Technique at the Frankfurt a./M. Municipal Hospital, which attracted a large attendance of superintendents, physicians, matrons, architects and engineers, coming from seventeen different countries. More than thirty internationally known specialists delivered lectures on important problems. Lively discussions followed their statements.

The lectures on kitchen management, hospital linen and laundry work have been published—after being completed by interesting articles of other authors—in the October issue of *Nosokomeion*, the official organ of the International Hospital Association. (Publisher W. Kohlhammer, Stuttgart.)

From June 28 to July 3, 1933, the Third International Hospital Congress will meet at Knocke s./Mer, on the Belgian coast. The Study Committees of the International Hospital Association will submit their reports to the Congress. The discussions will enable the Congress to draw up the outlines of practical conclusions having an international value. A five-day study trip to the Netherlands will follow the Congress.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

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Communications in regard to editorial business should be addressed—"The Editor, Journal of the Royal Army Medical Corps, War Office, Whitehall, London, S.W. 1."

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Original Communications.

AN INVESTIGATION INTO THE BACTERIAL POLLUTION OF SWIMMING BATHS.[1]

With special reference to:—

(1) The Normal Bacterial Flora, the pathogenic organisms present and their importance in relation to the spread of disease.

(2) The viability of certain micro-organisms, chiefly of the coli-typhoid-dysentery group, in fresh-water and sea-water.

(3) A study as to the presence of Bacteriophage in fresh, sea, and sea-bath waters.

BY THE LATE MAJOR B. L. DAVIS, O.B.E.,
Royal Army Medical Corps.

Section I.

THE PATHOGENIC ORGANISMS THAT CAN BE ISOLATED FROM SWIMMING BATHS, WITH SPECIAL REFERENCE TO SEA-WATER BATHS AND THEIR IMPORTANCE IN THE SPREAD OF DISEASE.

INTRODUCTION.

ON reviewing the literature on the subject of the bacterial pollution of swimming baths, the most outstanding fact seemed to be that only a very small number, if any, of investigations had been carried out on the question of the pollution of sea-water swimming pools. The great majority of the investigations dealt with fresh-water baths. In view of the fact that in many places sea-water swimming pools exist, it appeared that the part played by them as possible sources of infection was worthy of investigation from the point of view of the public health, and the present investigation was therefore carried out.

[1] Thesis for the degree of Doctor of Medicine.

The baths on which this work was done were the Corporation Baths in the City of Aberdeen.

At the same time an investigation was also conducted into the effects of filtration and chlorination of the water on the bacterial counts in ordinary fresh-water swimming-bath water in the Middle School Baths, also in the City of Aberdeen.

Review of the Previous Literature on the Bacterial Pollution of Swimming Baths.

As already stated, most of this work has been done on the Bacterial pollution of fresh-water swimming pools.

In 1910, Pearce and Sutherland published their results on the bacterial counts of water taken from the public swimming baths at Batley, in Yorkshire, and according to them the counts ranged from 3,000 to 300,000 organisms per cubic centimetre.

In 1912, Graham Forbes examined the water from a small swimming bath at an industrial school in London. This bath was used daily by twelve to twenty-four boys, who were made to wash with soap and water before entering the bath. The water was changed twice weekly. The unpolluted water showed a count of 100 organisms per cubic centimetre, chiefly of the proteus group, but after two to three days the average count had risen to 4,000, and the organisms then included *Streptococcus fæcalis*, *Staphylococcus aureus*, *B. coli*, *B. proteus* and Gram-negative diplococci from saliva.

In 1923, the American Public Health Association appointed a Committee on Bathing Places, who recorded as their findings that the methods usually employed for the analysis of potable waters do not show the true sanitary condition of the waters of swimming pools. They recommended that a special study of the bacterial flora of swimming pools should be made as a basis for the special methods for the bacteriological examination of such waters and, pending this being done, that the standard of quality of the water tentatively to be adopted should be as follows :—

(1) *Bacterial Count on Agar—Two Days at* 20° *C.*

Not more than ten per cent of the samples covering any considerable period of time shall exceed 1,000 bacteria per cubic centimetre. No single sample shall contain more than 5,000 per cubic centimetre. (This count was to be optional.)

(2) *Bacterial Count on Agar or Litmus Lactose Agar for Twenty-four Hours at* 37° *C.*

Not more than ten per cent of the samples covering any considerable period shall contain more than 100 bacteria per cubic centimetre. No single sample shall contain more than 200 bacteria per cubic centimetre.

(3) *Bacterium coli: Partial Confirmatory Test.*

Not more than two out of five samples collected on the same day, or not

more than three out of any ten consecutive samples collected on different dates to show a positive test in ten cubic centimetres of the water.

This standard was laid down on the ground that all bathers must inevitably swallow small amounts of the water.

W. B. Mallmann, in a paper issued in the *American Journal of Public Health*, 1928, points out that under laboratory conditions *B. coli* will grow abundantly in swimming-pool water. He also proved by experiment that *B. coli* tend to multiply in the swimming pool, whilst streptococci do not.

He carried out a series of experiments as follows:—

(A) *A Study of the Pool when in use.*

During the morning with only a few bathers, a marked reduction in streptococci and also a decrease of *B. coli* occurred. In the afternoon, with a larger attendance, the number of streptococci increased; but there was no increase in *B. coli*; in fact there was a slight decrease in three experiments.

(B) *Study of the Pool when not in use.*

Single samples were collected on Thursday night, Friday morning, and then from Saturday morning to Sunday night a sample was taken at three-hourly intervals.

B. coli increased during Thursday night, and the streptococcal content was reduced to zero. During Friday, when the pool was in use, streptococci increased more than *B. coli*. On Friday night both *B. coli* and streptococci decreased up to 3 p.m. on Saturday afternoon, when the pool was again used. At this time the streptococci increased decidedly, whilst only a slight increase in *B. coli* occurred. By 9 a.m. on Sunday, the streptococci had practically disappeared; the *B. coli*, however, though fewer, were present in higher numbers than would conform to the standard test.

(C) *Behaviour of B. coli and Streptococci during the Night.*

The streptococci dropped from a large number the night before to a small number in the morning. On the other hand there was little or no decrease in the *B. coli* during the night. Filters were working all the time.

This paper is recorded here at some length because it has a definite interest to the writer on account of the conclusions drawn by Mallmann from the results of his experiments.

He states that the average decrease of streptococci amounted to 66·5 per cent, whilst in the case of *B. coli* the reduction was only 0·6 per cent, and from this he argues that *B. coli* must have multiplied in the pool, for the filters removed a large number of the organisms, and would thus have produced a marked reduction in numbers unless multiplication in the water had taken place. The reduction in the number of streptococci indicates, in his opinion, that the streptococci do not grow.

Whilst the writer admits that this is a possible explanation, still it does not appear to clear up the whole situation. It will be admitted that the process of filtration that was being carried on would affect approximately the reduction of the *B. coli* and streptococci in the same proportion. The reduction in the actual number of streptococci, to give the figures, is 66·5 per cent, whereas that of *B. coli* is only 0·6 per cent, and this reduction occurred in one night. The writer's own experiments in another section of this work show that *B. coli* live for a much greater period of time in water than do the streptococci, so that it is quite possible that the streptococci died out in the period, whereas the *B. coli* were unaffected.

This, however, appears to be only part of the explanation. The more probable explanation lies in the fact that there was present in the water some substance introduced by the bathers, whether it was in the form of saliva, urine or some other chemical compound, which exerted a definite bactericidal or lytic effect on the streptococci present, but left unharmed the *Bacterium coli*. It would have been of great value if, at the time of these experiments, the swimming-pool water had been tested for the possible presence of a bacteriophage which was definitely antagonistic to the streptococci present.

The other conclusions that Mallmann drew from his experiments were :—

(1) *B. coli* are not a universally reliable indicator of intestinal pollution in swimming pools.

(2) Streptococci are constant indicators of intestinal pollution and the number found in the pools parallels the amount of pollution as indicated by the number of bathers.

(3) Streptococci when present indicate an unsafe condition of the swimming pool.

(4) *B. coli* do not necessarily indicate pollution or danger although the absence of *B. coli* is an excellent index of safety.

The writer cannot agree, however, with the conclusions adopted in (2) above, namely, that the streptococci are constant indicators of intestinal pollution, for one of the commonest of the streptococci found in swimming pool water is *S. salivarius*, which is not of intestinal origin, and in addition the writer himself has on three occasions isolated from the water of a swimming pool *Str. hæmolyticus* which is definitely not of intestinal origin. The finding of *Str. fæcalis* certainly does favour this view, but it would appear that as practically every person who uses a swimming bath must at some time while in the water spit out swallowed water, the amount of *Str. salivarius* introduced must essentially outweigh in numbers any fæcal streptococci that may be introduced.

Stokes in the *American Journal of Public Health*, 1927, gives the results of an investigation carried out by him as to the pathogenic bacteria found in swimming pools. During the summer of 1925 and 1926 he took 2 gallons

of water at each of 15 tests from 7 indoor and 7 outdoor swimming pools. The water was filtered through two layers of No. 1 filter paper and the sediment mixed with 100 cubic centimetres of sterile distilled water. After shaking, 0·1 cubic centimetre of this was spread over 2 blood-agar plates, and 0·1 cubic centimetre over 2 plates of eosinate of methylene blue agar. By this method he studied 500 colonies in pure culture, and yet the only pathogenic organism isolated by him was the *Staph. albus*.

Griffiths by mouse inoculation succeeded in isolating *Str. hæmolyticus* from twenty cubic centimetres of a badly polluted bath water. The organism was specially sought for on four occasions, but this was the only time it was found.

The Results of the Bacterial Counts made in the Present Series of Experiments.

A series of fifty-two samples of sea-bath water was examined for counts.

Method adopted.—The water was collected in sterile stoppered bottles. The bottles were taken down daily in sterile copper containers by the writer, and the samples collected personally by him. They were, on practically all occasions, collected during the forenoon, though through pressure of work, samples had occasionally to be collected in the afternoon. These were immediately taken back to the laboratory by car and there plated out by the following method. After mixing by shaking, one cubic centimetre of the sample was removed by a sterile pipette and placed on a sterile petri dish. The agar plates were prepared by melting tubes of agar by heating in boiling water, cooling them down to 40° C., and pouring them at this temperature into the petri dish to which one cubic centimetre of the sample had already been added. The water was intimately mixed with the agar by gently rocking the plate. The plates thus prepared were then cooled on a horizontal surface and transferred to the incubator as soon as hard, and were then incubated for forty-eight hours.

A second plate from the same sample was also prepared as under :—

Test tubes each containing ten cubic centimetres of agar were melted in boiling water and then cooled down to 40° C. To these tubes, under precautions to ensure sterility, one cubic centimetre of the sample of water to be tested was added with a sterile pipette. This was now thoroughly mixed with the agar, poured into a sterile petri dish and allowed to harden on a horizontal surface and then incubated for forty-eight hours. In this way two plates were prepared for each sample, and at the end of the period both plates were counted and the average of the two plates was taken as the total count and recorded as set out in the following tables.

These investigations were carried out daily over a period of approximately three and a half to four months, except Sundays and during a period of fourteen days when the baths were closed.

A further fifty-two samples of natural sea-water were taken at the same time and plated for counts for comparative purposes.

A series of fifty-two samples was also taken from the Middle School Baths and treated in the same way to ascertain the effect of chlorination of the water. In this bath chlorine is added so as to give the bath water a constant content of three parts per 1,000,000 of chlorine.

RESULTS OF THIS INVESTIGATION—BACTERIAL COUNTS.

(1) The first thing that was noticeable about the results was the low bacterial count obtained from this sea-water swimming pool as compared with those reported from fresh water bathing pools.

Pearce and Sutherland obtained counts of 300,000 organisms per cubic centimetre on gelatine at 22° C. from fresh water of a bath which had been in use for three days by 974 people. On another occasion a gelatine count of 63,000 organisms per cubic centimetre was found after four days use by 938 persons.

Bowes, in a paper in the *Journal of State Medicine*, 1928, gives the following counts on gelatine (after seventy-two hours incubation): First day after use by 215 males, 2,700; second day after use by 324 males and 63 females, 347,000.

The agar counts at 37° C. (forty-eight hours incubation) for these two samples were 600 and 105,000 per cubic centimetre respectively.

In this series obviously the count has absolutely no relation to the number of bathers.

In another bath where the water was untreated, Bowes got a count of 1,788,000 organisms per cubic centimetre.

Forbes, who examined forty-two samples from untreated water taken from five artificial open-air swimming pools found the average count on agar at 37° C. for forty-eight hours was 950 per cubic centimetre—the highest being 200,000, and the lowest 1 per cubic centimetre.

For comparison with these results, Forbes examined the water from two artificial pools with continuous filtration and chlorination and found: 17 samples from one bath showed an average count of 50 per cubic centimetre —the highest being 500—but in 10 of these samples the total count was below 10 per cubic centimetre. Nine samples were taken from the second pool and the average count on agar was 10—the highest being 13 and the lowest 4.

In 36 samples from three well-used indoor pools with continuous filtration and chlorination, the average count on agar at 37° C. was 150 per cubic centimetre.

In the writer's own experiments the results shown in the following tables were obtained; the counts are definitely low as compared with those of other writers.

It must, however, be remembered that the writer was working with sea-water baths and the other workers were dealing with fresh-water baths.

TABLE SHOWING SUMMARY OF THE RESULTS OF COUNTS MADE ON AGAR AT 37° C. (48 HOURS) OF THE VARIOUS WATERS TESTED.

Sample	No. of samples	Average count per 1 c.c.	Highest count per 1 c.c.	Lowest count per 1 c.c.	Remarks
Sea-water from the sea itself	52	27·3	126	3	..
Sea-water bath after use	52	408·6	825	10	Water untreated
Middle School bath	57	5·8	48	0	Water treated by continuous filtration and chlorination.

(2) This series of experiments confirms the results of the work of other writers; it again proves that the bacterial count is in no way related to the actual number of people who use the bathing pool.

(3) The most significant thing in these results is what appears to occur after the bath has been emptied and filled with fresh sea water. The count on that day is low, as would be expected, then for the next few days it rises markedly and then shows a definite fall, and this in spite of the fact that additional people have used the bath, and are therefore continually adding large numbers of bacteria to the water. The natural thing to expect would have been that there would have been a considerable and progressive rise in the bacterial count.

The question therefore arises as to what is the cause of this fall in the count. There are three possible explanations :—

(1) That the death of the bacteria introduced into the water is brought about by some factor of a non-bacterial nature which occurs either as a result of loss of gas content, probably dissolved oxygen in the water, or is due to urine, fatty acids, etc., or to other factors introduced at the time by the bathers in addition to bacteria.

(2) A more feasible explanation would appear to be that there develops in the water as the result of the introduction of these organisms, a substance produced by the organisms of the nature of a ferment which has a definite destructive or lytic action on the organisms which are introduced at later dates. This substance was considered by the writer to be of the same nature as that described by Twort and D'Herelle to which has been given the name "bacteriophage." A series of experiments was therefore commenced to prove whether there existed in sea-bath water any bacteriophage for ten definitely selected organisms, which were proved to be non-resistant to the action of their own specific bacteriophage. The results as shown later were in all cases negative, and therefore this explanation will not stand.

The argument that appeared to be rational and led to the investigation of this question of bacteriophage was as follows :—

If, for instance, on the first day that this water was used, say 1,000 organisms were introduced giving rise, to put it in measurable terms, to a

dilution of 1/100,000,000 of bacteriophage, and on the second and third days a further 1,000 organisms were introduced, producing a similar amount of bacteriophage in the water, then at the end of this period bacteriophage might be present to a dilution of, say, 1/10,000,000. A point would ultimately be reached where the amount of bacteriophage present in the water would be sufficient to begin to exert its lytic or destructive action on the organisms. Once this point was reached this lytic action would be progressive and destruction of the organisms would therefore result more rapidly, and the total count made from the water would fall.

TABLE I.—TABLE SHOWING THE RESULTS OF BACTERIOLOGICAL COUNTS.

Sea-Bath Water.

Sample	Count at end of 48 hours on agar	Remarks
A	465	
B	445	
C	502	
D	176	Day after the water was changed
E	440	
F	527	
G	605	
H	465	
I	212	Day after the water was changed
J	265	
K	320	
L	325	
M	255	
N	227	
O	240	Day after the water was changed
P	320	
Q	460	
R	535	
S	520	
T	630	
U	570	
V	370	
W	385	Day after the water was changed
X	395	
Y	410	
Z	560	

However, no evidence has been obtained of the presence of any bacteriophage.

(3) Another possible explanation of this phenomenon may be that when the water is first changed the new water contains a good food supply which tends to diminish as time goes on. Further, there is also introduced into the water by the bathers themselves, material from the skin, etc., which increases this food supply. It is possible that the saliva and urine introduced might help to turn the bath water into a culture medium and so aid the survival of the organisms, since bacteriophage

TABLE II.—TABLE SHOWING THE RESULTS OF BACTERIOLOGICAL COUNTS.

Sea-Water.

Sample	Count at end of 48 hours on agar	Remarks
A	5	
B	10	
C	32	
D	13	
E	69	
F	72	
G	81	
H	84	
I	65	
J	13	
K	8	
L	10	
M	14	
N	6	
O	30	
P	3	
Q	29	
R	9	
S	22	
T	29	
U	18	
V	12	
W	15	
X	28	
Y	23	
Z	3	

TABLE III.—TABLE SHOWING THE RESULTS OF BACTERIOLOGICAL COUNTS.

Middle School Bath (Fresh Water Chlorinated and Filtered).

Sample	Counts	Remarks
A	9	
B	4	
C	13	
D	6	
E	310	Chlorine apparatus out of order
F	266	Chlorine apparatus out of order
G	9	
H	5	
I	3	
J	5	
K	7	
L	4	
M	1	
N	3	
O	3	
P	5	
Q	9	
R	9	
S	5	
T	5	
U	2	
V	13	
W	9	
X	8	
Y	1	
Z	490	Chlorine apparatus out of order

has been proved absent. In addition to all this, it must be borne in mind that these baths are maintained at a temperature varying from 70° to 74° F., whereas the original temperature of the sea water was 35° to 40° F.

Therefore the organisms introduced by the bathers meet at first with a favourable temperature, a favourable food supply and also possibly other factors that help them to live—if not multiply. Later these favourable factors tend to decrease with resulting death of a large number of the organisms, only the more resistant being able to survive under these relatively unfavourable circumstances.

Whatever the explanation may be, and as far as the writer can prove experimentally it is not the development of bacteriophage, there is no doubt that in these experiments from the time of filling the bath there is a definite increase in the number of organisms, followed by a decrease, despite the fact that there is a steady increase in the numbers of organisms being introduced. The fact that this rise and fall does occur, is well shown by the graph, reproduced in a later section.

(4) It is very obvious from the tables in this section that although the counts per cubic centimetre in the sea-bathing pool are low in comparison with the counts reported by other writers for fresh-water bathing pools, yet at the same time there is a very marked increase compared with the count in the natural sea-water, and that a very considerable number of organisms are added by the bathers to the water. Reference to the graph demonstrates this very clearly.

An attempt was made by the writer to try and isolate the various organisms which were added to sea-water by the bathers, and this is reported on later in this paper.

(5) Further, in these investigations one could not help being struck by the very small numbers of organisms per cubic centimetre present in the fresh water of the Middle School Baths, which, as has been stated, is constantly undergoing chlorination and filtration.

This is therefore another definite instance of the good effect of the continuous chlorination of the waters of bathing pools.

(6) From the total counts and the tables submitted, it is obvious that sea-water is preferable to ordinary water in those baths where no method of purification is used.

Bacterium coli IN SEA-BATH WATER AFTER USE.

In order to test the amount of *B. coli* present in the water, the water was inoculated in the amounts shown into MacConkey broth and incubated for forty-eight hours at 37° C. As a control series the same quantities of ordinary natural sea-water were also inoculated into the same media and incubated for the same period.

The samples of sea-bath water and sea-water were taken on the same day consecutively throughout the same period.

In sea-bath water the *B. coli* was found present as shown in the following table :—

Organism	Smallest quantity of sample giving positive results	Number of times present in this quantity
B. coli communis	0·5 c.c.	1
,, ,, ...	1 ,,	17
,, ,, ...	5 ,,	33
,, ,, ...	25 ,,	On all occasions.

The *B. coli* was therefore present in 0·5 cubic centimètre on one occasion, in 1 cubic centimetre on 17 occasions, and in 5 cubic centimetres on 33 occasions, and was present in the larger quantities, namely, 10 cubic centimetres and 25 cubic centimetres on all occasions, except that in one sample it was absent in 10 cubic centimetres, and in another sample in 5 cubic centimetres and 10 cubic centimetres.

The *B. coli* was shown to be absent from twenty-five cubic centimetres natural sea-water on all occasions but one, and on that occasion was present in five cubic centimetres. On that occasion the sea was very rough and the occurrence of the bacillus may be accounted for by the fact that, on account of the gale, sewage was washed inshore from a sewage outfall about a mile away.

Fifty-two samples of sea-water and of sea-bath water were examined, and it would appear from these tables that bathers in sea-water swimming pools do introduce and add a very considerable quantity of *B. coli* to the water. That the *B. coli* so introduced is of human origin is fairly obvious, in that the sea-water on all occasions showed definite absence of this organism, and therefore the *B. coli* was not added by means of gulls, other birds or fish or mammals.

Middle School Baths.—In this case the water is filtered and chlorinated, three parts of chlorine per 1,000,000 being added to the water. Fifty-two separate samples of this water were examined. On one occasion the *B. coli* was present in ten cubic centimetres, but on investigation it was found that on that day the chlorine apparatus was not working properly.

With the exception of this day, the *B. coli* was never found in 25 cubic centimetres; on 4 occasions it was present in 50 cubic centimetres, and on 16 occasions in 100 cubic centimetres.

This result would appear a very sound argument for the continuous chlorination of sea-bath water during its use.

Forbes took forty-two samples of untreated water from five large open-air swimming pools in London, and found that the content of *B. coli* in these samples was as follows : Present in 1 cubic centimetre in 19 samples ; in 5 cubic centimetres in 10 samples ; in 10 cubic centimetres in 3 samples, and absent from 10 cubic centimetres in 10 samples.

B. coli in Sea-bath Water.

Results of Inoculating the Amounts shown into MacConkey Broth and Incubating at 37° C. for 48 Hours.

P = Presumptive Test. C = Confirmatory Test.

Sample	0·1 c.c. P	0·1 c.c. C	0·5 c.c. P	0·5 c.c. C	1 c.c. P	1 c.c. C	5 c.c. P	5 c.c. C	10 c.c. P	10 c.c. C	25 c.c. P	25 c.c. C
A	—	—	+	+	+	+	+	+	+	+	+	+
B	—	—	—	—	—	—	+	+	+	+	+	+
C	—	—	—	—	—	—	+	+	+	+	+	+
D	—	—	—	—	+	+	+	+	+	+	+	+
E	—	—	—	—	+	+	+	+	+	+	+	+
F	—	—	—	—	—	—	+	+	+	+	+	+
G	—	—	—	—	—	—	+	+	+	—	+	+
H	—	—	—	—	—	—	+	+	+	+	+	+
I	—	—	—	—	—	—	+	+	+	+	+	+
J	—	—	—	—	—	—	—	—	+	+	+	+
K	—	—	—	—	+	+	+	+	+	+	+	+
L	—	—	—	—	+	+	+	+	A	—	+	+
M	—	—	—	—	—	—	+	+	+	+	+	+
N	—	—	—	—	—	—	+	+	+	+	+	+
O	—	—	—	—	—	—	+	+	+	+	+	+
P	—	—	—	—	—	—	+	+	+	+	+	+
Q	—	—	—	—	—	—	+	+	+	+	+	+
R	—	—	—	—	+	+	+	+	+	+	+	+
S	—	—	—	—	—	—	+	+	+	+	+	+
T	—	—	—	—	—	—	A	—	A	—	+	+
U	—	—	—	—	—	—	—	—	+	+	+	+
V	—	—	—	—	—	—	—	—	+	+	+	+
W	—	—	—	—	+	+	+	+	+	+	+	+
X	—	—	—	—	—	—	+	+	+	+	+	+
Y	—	—	—	—	+	+	+	+	+	+	+	+
Z	—	—	—	—	+	+	+	+	+	+	+	+

+ = production of acid and gas. A = production of acid only.

B. coli in Sea Water.

Results of Inoculating the Amounts shown into MacConkey Broth and Incubating for 48 Hours at 37° C.

P = Presumptive Test. C = Confirmatory Test.

Sample	1 c.c. P	1 c.c. C	5 c.c. P	5 c.c. C	10 c.c. P	10 c.c. C	25 c.c. P	25 c.c. C	50 c.c. P	50 c.c. C	100 c.c. P	100 c.c. C
A	—	—	—	—	—	—	—	—	not	done	not	done
B	—	—	—	—	—	—	—	—	,,	,,	,,	,,
C	—	—	—	—	—	—	—	—	,,	,,	,,	,,
D	—	—	—	—	—	—	—	—	,,	,,	,,	,,
E	—	—	—	—	—	—	—	—	,,	,,	,,	,,
F	—	—	—	—	—	—	—	—	,,	,,	,,	,,
G	—	—	—	—	—	—	—	—	,,	,,	,,	,,
H	—	—	—	—	—	—	—	—	,,	,,	,,	,,
I	—	—	+	+	+	+	+	+	,,	,,	,,	,,
J	—	—	—	—	—	—	—	—	,,	,,	,,	,,
K	—	—	—	—	—	—	—	—	,,	,,	,,	,,
L	—	—	—	—	—	—	—	—	,,	,,	,,	,,
M	—	—	—	—	—	—	—	—	,,	,,	,,	,,
N	—	—	—	—	—	—	—	—	,,	,,	,,	,,
O	—	—	—	—	—	—	—	—	,,	,,	,,	,,
P	—	—	—	—	—	—	—	—	,,	,,	,,	,,
Q	—	—	—	—	—	—	—	—	,,	,,	,,	,,
R	—	—	—	—	—	—	—	—	,,	,,	,,	,,
S	—	—	—	—	—	—	—	—	,,	,,	,,	,,
T	—	—	—	—	—	—	—	—	,,	,,	,,	,,
U	—	—	—	—	—	—	—	—	,,	,,	,,	,,
V	—	—	—	—	—	—	—	—	,,	,,	,,	,,
W	—	—	—	—	—	—	—	—	,,	,,	,,	,,
X	—	—	—	—	—	—	—	—	,,	,,	,,	,,
Y	—	—	—	—	—	—	—	—	,,	,,	,,	,,
Z	—	—	—	—	—	—	—	—	,,	,,	,,	,,

B. coli in Middle School Bath (Water Chlorinated).

Results of Inoculating the Amounts shown into MacConkey Broth and Incubating for 48 Hours at 37° C.

P = Presumptive Test. C = Confirmatory Test.

Sample	1 c.c.		5 c.c.		10 c.c.		25 c.c.		50 c.c.		100 c.c.	
	P	C	P	C	P	C	P	C	P	C	P	C
AA	–	–	–	–	–	–	–	–	–	–	–	–
BB	–	–	–	–	–	–	–	–	–	–	–	–
CC	–	–	–	–	–	–	–	–	–	–	–	–
DD	–	–	–	–	–	–	–	–	–	–	+	+
EE	–	–	–	–	–	–	–	–	–	–	+	+
FF	–	–	–	–	–	–	–	–	–	–	–	–
GG	–	–	–	–	–	–	–	–	–	–	–	–
HH	–	–	–	–	–	–	–	–	–	–	–	–
II	–	–	–	–	–	–	–	–	–	–	+	+
JJ	–	–	–	–	–	–	–	–	–	–	–	–
KK	–	–	–	–	–	–	–	–	–	–	–	–
LL												
MM	–	–	–	–	–	–	–	–	–	–	–	–
NN	–	–	–	–	–	–	–	–	–	–	+	+
OO	–	–	–	–	–	–	–	–	–	–	+	+
PP	–	–	–	–	–	–	–	–	–	–	–	–
QQ	–	–	–	–	–	–	–	–	–	–	–	–
RR	–	–	–	–	–	–	–	–	–	–	–	–
SS	–	–	–	–	–	–	–	–	–	–	+	+
TT	–	–	–	–	–	–	–	–	–	–	–	–
UU	–	–	–	–	–	–	–	–	–	–	+	+
VV	–	–	–	–	–	–	–	–	–	–	–	–
WW	–	–	–	–	–	–	–	–	–		–	–
XX	–	–	–	–	–	–	–	–	–	–	–	–
YY	–	–	–	–	–	–	–	–	–	–	–	–
ZZ	–	–	–	–	–	–	–	–	–	–	+	+
AAA	–	–	–	–	–	–	–	–	–	–	+	+
BBB	–	–	–	–	–	–	–	–	–	–	–	–
CCC	–	–	–	–	–	–	–	–	–	–	–	–
DDD	–	–	–	–	–	–	–	–	–	–	+	+
EEE	–	–	–	–	–	–	–	–	–	–	–	–
FFF	–	–	–	–	–	–	–	–	–	–	–	–
GGG	–	–	–	–	–	–	–	–	–	–	–	–
HHH	–	–	–	–	–	–	–	–	–	–	–	–

On another occasion Forbes took twenty-six samples from two large open-air artificial pools with continuous filtration and chlorination. From one bath he examined seventeen samples. Of these, *B. coli* was absent in 12 of the 17; present in 10 cubic centimetres in 2 samples; in 5 cubic centimetres in 2 samples; in 1 cubic centimetre in 1 sample, but in this case the plant was not working. From the second bath he took nine samples and found: *B. coli* was present in 10 cubic centimetres in 4 samples; in 5 cubic centimetres in 1 sample (the plant in this case was not working), and absent from 10 cubic centimetres in 4 samples.

In 36 samples from three well-used indoor swimming pools with continuous filtration and chlorination the same writer found: *B. coli* was absent in 29 samples out of 36 from 10 cubic centimetres of the water; present in 10 cubic centimetres in 3 samples; and present in 5 cubic centimetres in 2 samples.

Comparing these results with those obtained by the writer as shown in the tables, it is found that in the case of the untreated water they are

very similar; but in the water subjected to chlorination and filtration, the *B. coli* was never found in 25 cubic centimetres (59 samples), and only on one occasion, when the plant was definitely not working, was it found in 10 cubic centimetres.

Throughout the writer's own experiments, not only were the presumptive tests for the *B. coli* carried out, but also confirmation tests by the following method:—

From the smallest amount of the sample in MacConkey's broth giving acid and gas (a positive presumptive test) plates of MacConkey's agar were spread and incubated over night at 37° C.

Lactose fermenting colonies were picked from these plates and identified as the *B. coli* by morphological, staining, and sugar fermentation tests, the production of acid and clot in milk, and the formation of indol in peptone water.

The results obtained are shown in the preceding tables for Sea-bath Water (untreated); Sea-water; Middle School water (subjected to continuous filtration and chlorination).

(*To be continued.*)

INVESTIGATIONS INTO CASES OF CEREBROSPINAL FEVER IN THE NORTHERN COMMAND OF THE ARMY DURING 1931, CONCLUDING WITH A PLEA FOR THE EARLY DIAGNOSIS OF THE DISEASE.

By Major W. WALKER, M.C.,
Royal Army Medical Corps.

(*Concluded from p.* 15.)

Contacts and Carriers.

On a case suspected to be cerebrospinal fever occurring in barracks, the remaining men in the barrack-room were isolated in their quarters, which, of course, included messing in their quarters until the arrival of the pathologist. The question as to who were to be regarded as immediate contacts and who were to be swabbed rested entirely with that individual.

This is only right because this type of work is in a special class by itself, especially when it has to be undertaken at a long distance from the laboratory. Very few persons outside a bacteriological laboratory realize the work entailed in getting the special media plates prepared, conveying them at a suitable temperature in their cumbersome boxes, together with other necessary apparatus, to the abode of the contacts; the time taken in the deliberate swabbing behind and beyond the soft palate and in the careful spreading of the material over the surface of the medium, and finally, the after-work in the laboratory in the differentiation of the meningococcus from the other numerous denizens of the nasopharynx. The technique required is so specialized that it cannot be carried out by subordinates. There is therefore a very definite limit to the amount of material that can be dealt with efficiently by one bacteriologist.

As a general routine the remaining occupants of the barrack room from which a case had been removed were considered the immediate contacts and as such were all swabbed. This is more satisfactory than the swabbing of the immediate adjacent contacts because the resulting cultures portray the pharyngeal state of the room as a whole, and afford evidence for or against defective hygienic conditions within the barrack room.

Nasopharyngeal disinfection was postponed until the swabbing had taken place, after which the contacts gargled and insufflated a 1 in 5,000 dilution of potassium permanganate in normal saline solution thrice daily. The bacteriological results of the swabbing were notified in forty-eight hours, all the non-carriers being immediately liberated.

The Treatment and Control of Carriers.

Carriers were either isolated in the infectious diseases blocks of military hospitals or, more generally, in special quarters set apart in barrack rooms. In addition to the routine gargling and nasal insufflation, as recorded above,

the carriers were given as much out-door employment as possible; in quarters, liberal bed-spacing and free ventilation were strictly maintained. No other routine form of treatment was instituted.

Carriers were swabbed every seven to ten days. No carrier was allowed to return to duty until two successive examinations of his nasopharynx were negative.

Duration of the Carrier State.

Seventy-seven per cent of carriers ceased to be carriers within fourteen days and ninety-two per cent within three weeks. One woman, the mother of the child who caught the infection, persisted in the carrier state for two months, and a contact carrier (giving a pure growth on a plate) of the first Strensall case remained positive for three months.

The Health of the Carriers.

On examination some sixty per cent of carriers were found to be suffering from nasopharyngitis of some degree. In the majority the condition did not give rise to any discomfort, but in ten per cent it was definitely acute. A pure plate culture of the meningococcus has several times been obtained from a carrier with an apparently normal throat. No detected carrier developed the disease, or, as far as I have been able to trace, was admitted to hospital with acute toxic pharyngitis.

General Consideration regarding the Routine Custom of Swabbing Contacts.

Contacts are swabbed with two ends in view. These are: (*a*) to detect and isolate carriers in the hope of arresting the spread of infection; (*b*) To make the public feel that something definite is being done to stop the spread of the disease

With regard to (*a*), I have frequently doubted the practical value of swabbing a collection of contacts and isolating the unfortunate detected carrier in military communities. The soldier father working in an infected area is an exception; he should be prevented, if possible, from carrying home infection to young, susceptible children. In general barrack procedure, when a case occurs, a few carriers are detected and isolated, but a large number of equally dangerous individuals in other parts of the community continue to mix with their fellow men, completely uncontrolled. The individual who gets infected with the identical strain of meningococcus, but who, by virtue of a partial immunity, arrests the infection in the acute catarrhal stage, causes no apprehension among his fellow men, and his immediate contacts remain undisturbed, continuing to harbour some carriers in their midst. When viewed in this light, our present procedure does not appear to be very practical. Can the energies of the pathologist be expended on more useful lines than travelling back-

wards and forwards on long journeys to re-swab some carriers again and again until two negative swabs in succession are obtained from each one? He would be rendering much more useful service if his energies were concentrated on the prevention of the disease rather than following in the aftermath of a case. By keeping a bacteriological control on a community threatened with infection he should be able to give a timely warning, when energetic steps could be taken by those concerned to overhaul the hygienic condition of the unit. If a case occurs in barracks certainly let a non-contact barrack room also be swabbed. Compare the two results; if they are equally bad then it can be taken that the whole unit requires immediate attention by the responsible authorities, and appropriate steps having been taken, the pathologist can return in three weeks and estimate the results of their labours. Any carriers detected should be isolated under good hygienic conditions and given outdoor occupation. At the end of three weeks they should be returned to duty without further examination.

The energies of the pathologist should also be directed towards the routine investigation of catarrhal conditions in the upper air passages when meningococcal infections are known to be prevalent. By this means he will be able to detect a case of cerebrospinal fever in its earlier manifestations, and by the prompt application of active and appropriate measures may either abort a meningeal invasion, or at least lessen the intensity of its inflammatory activity. His attitude in life must not be of a passive nature, waiting in his laboratory until invited by the clinician to carry out some particular tests on a suspicious case. By so doing he may, sometimes, be anticipating the presence of the undertaker by a short two or three days.

In a controlled community, the pathologist is the mainspring of everything pertaining to cerebrospinal fever, its prevention, early detection and appropriate specific treatment. In this connection he must be prepared to elaborate practical schemes suitable to the area under his control for the best means of dealing with the infection in all its aspects.

With regard to (*b*) the allaying of public alarm. Until we know much more about the factors governing the mode of infection and spread of this disease we are not in a strong enough position to refuse to take elaborate steps with regard to immediate contacts, especially in a Service supported by the public purse. Until that extra knowledge is forthcoming the present practice, with regard to contacts, must remain in force.

Summary of Carrier Investigations.

	Total swabbed	Number positive	Carrier rate per cent
(1) Swabs from suspected cases	26	11	42·3
(2) Contacts, primary swabbing	177	37	21
(3) Contact carriers, subsequent swabbing	114	29	25
(4) Non-contact swabs	190	37	20
Totals ..	507	114	22·28

PART II.

Early Diagnosis.

General Considerations.

The finding of clear cerebrospinal fluid at the diagnostic lumbar puncture is evidence that an early diagnosis has been made. The value of early diagnosis is illustrated by comparing the appearances of the cerebrospinal fluid at the diagnostic lumbar puncture in the cases investigated from the Command Laboratory in 1931, with the mortality-rate against each type.

Turbid cerebrospinal fluid, 6 ; mortality 83 per cent
Clear cerebrospinal fluid, 4 ; mortality 50 per cent

Early in 1932, six additional cases were investigated. A similar analysis gives :—

Turbid cerebrospinal fluid, 2 ; mortality 50 per cent
Clear cerebrospinal fluid, 4 ; mortality *Nil*

Combining the findings from the sixteen cases the results are :—

Turbid cerebrospinal fluid, 8 ; mortality 75 per cent
Clear cerebrospinal fluid, 8 ; mortality 25 per cent

With early diagnosis and appropriate treatment the mortality-rate should not exceed twenty-five per cent of cases.

It may be argued that in some cases such early diagnosis is impossible, the fluid being turbid soon after the onset of the acute symptoms. In comparing the dates of onset of the symptoms with the dates of the diagnostic lumbar punctures in the eight cases with turbid fluid, it was found that there was an interval of from thirty-six to ninety-six hours between the onsets and the lumbar punctures, the average being fifty hours.

In no case lumbar-punctured within thirty-six hours of the onset has the cerebrospinal fluid been found turbid. The high mortality in cases with a turbid cerebrospinal fluid at the time of the diagnostic lumbar puncture is largely due to a delayed diagnosis.

It might therefore be said that the mortality-rate in this disease is largely in the hands of the clinicians who first see the cases.

What are the chief factors standing in the way of early diagnosis of cases? They are two in number : (*a*) The possibility of the disease being a meningococcus infection being entirely overlooked. (*b*) The reluctance on the part of many clinicians to diagnose the disease until some of the textbook symptoms are definitely established.

With regard to the first factor: This is apt to occur when an odd sporadic case presents itself to one who has had little experience of the disease. With increasing experience one acquires a "meningococcal outlook," and all influenzal-like infections are suspected to be of meningococcus origin until they can be proved to the contrary.

If this attitude were adopted at the present day during the prevailing

incidence of cerebrospinal fever, the occurrence of a sporadic case would not take the clinician unawares.

Influenza is the great stumbling-block over which the physician is apt to fall in the diagnosis of an early sporadic case of the disease. When once the physician is convinced that he is dealing with a case of influenza, he may fail to observe the signs of advance of the meningococcus from the nasopharynx until it is definitely established in his patient's subarachnoid space.

I could cite several cases treated as influenza until one day it was observed that there was definite neck stiffness and that Kernig's sign was present.

The second factor of delay is caused by waiting for the textbook symptoms of the disease to establish themselves. We are taught that the classical prodromal symptoms are headache, vomiting and pyrexia, soon to be followed up by neck stiffness and Kernig's sign. The Ministry of Health review on cerebrospinal fever[1] under "Clinical Considerations" reads :—

> "*Diagnosis* before its confirmation by lumbar puncture, is usually determined by five symptoms; intense headache, vomiting, pyrexia (usually moderate and associated with a comparatively slow pulse), stiffness of the neck muscles and Kernig's sign."

It naturally follows that the cautious physician, or one jealous of his diagnostic reputation, who waits until those symptoms are established will generally get a turbid cerebrospinal fluid at his diagnostic lumbar punctures. In the circumstances he must not expect a relatively low rate of mortality among his cases.

The early signs are there for those who can read them, but they are not always writ in capital letters.

A Note on Kernig's Sign.

Confusion arises from the early atypical symptoms found in many of the sporadic cases. There may be little or no vomiting. The temperature may be raised, normal or subnormal. Neck stiffness may be little more than tenderness of the neck muscles. Kernig's sign may be definitely positive, merely suggested, or absent.

During my investigations I have had more difficulties regarding Kernig's sign than with any other clinical manifestation of meningeal infection. To many clinicians Kernig's sign is either definitely positive or is entirely negative, there is no recognized intermediate state. Early in my investigations I learned the value of an intermediate form of this sign—"suggestion of Kernig"—from Captain F. J. O'Meara, F.R.C.P.I., Medical Specialist, Catterick. A "suggestion of Kernig" is present when the leg

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[1] Reports on Public Health and Medical Subjects, No. 65, Ministry of Health, London. 1931, p. 8.

can be all but straightened on the thigh, flexed at right angles, but the attempt to straighten it completely causes definite pain in the hamstrings. Subsequent observations have led me to realize the great value of a "suggestive" Kernig in determining the early onset of meningeal irritation. When once it is realized that the presence of a "suggestion" of Kernig is an important sign in the diagnosis of early meningitis, it will follow that laboratory investigations will be sought for such cases at an earlier period than would otherwise happen, and more cases would be diagnosed and treated before the cerebrospinal fluid became turbid.

Again, Kernig's sign may be absent in an early case when a clear cerebrospinal fluid is obtained at the first lumbar puncture. I have four such cases in my records. In all the cerebrospinal fluid subsequently became turbid; two cases were fatal.

The relation of Kernig's sign to the appearance of the cerebrospinal fluid at the diagnostic lumbar puncture in the sixteen cases cited above is summarized as follows :—

8, turbid cerebrospinal fluids—	Positive Kernig	7	
	"Suggestive" Kernig	1	(*a*)
	Negative Kernig	0	
8, clear cerebrospinal fluids—	Positive Kernig	1	(*b*)
	"Suggestive" Kernig	3	(*c*)
	Negative Kernig	4	(*d*)

(*a*) Very acute case. Died within four days.
(*b*) The only case diagnosed on purely clinical grounds. The case survived.
(*c*) All subsequently became positive, the cerebrospinal fluid becoming turbid. All survived.
(*d*) All subsequently became positive. In all the cerebrospinal fluid became turbid. Two cases died.

A Clinical Description of the Earliest Symptoms.

In a clinical description of the disease the earliest symptoms should be detailed to their fullest extent, for by so doing the physician may be guided towards an earlier diagnosis, when the prompt application of appropriate treatment may hold out better hopes for the ultimate recovery of the case.

Such a description, drawn from my recent experiences within the Northern Command, might read as follows :—

Clinically the disease is characterized by the sudden onset of headache, vomiting—often continued, with or without pyrexia. At a later period head retraction and Kernig's sign are established. Headache is the most constant early symptom. It is usually very intense and is, at first, frontal in location. Characteristically, it is continuous but sometimes it is only severe during acts of coughing. In the majority of cases vomiting occurs at the onset. This may be continuous or limited to one or two occasions. In some cases there is only nausea at this stage with no actual vomiting. Pyrexia is not invariable. When it occurs it is usually of moderate degree and is often associated with a relatively slow pulse. In some cases the temperature is normal, or even subnormal.

There are two recognized stages of the disease: (1) The premeningitis stage; (2) the stage of established meningitis.

(1) *The Premeningitis Stage.*—This is of variable duration, depending on the intensity of the infection. On the average it lasts from thirty-six to forty-eight hours, but may be extended to ninety-six hours. In this stage the symptoms resemble those of an acute toxic influenza or an acute toxic catarrhal pharyngitis.

The patient looks more seriously ill than his outward condition would appear to warrant. Early in this stage there are three symptoms constantly present: (*a*) profound toxæmia; (*b*) intense headache, usually frontal in location; (*c*) acute catarrhal pharyngitis. This differs from the "dry catarrh" of influenza.

At the earliest stage the mental attitude is characteristic. There is a definite apathy, an air of detachment from things in general. The patient is clear and lucid when spoken to. Later this state gives way to excitability, delirium or coma when the stage of meningitis is established.

Very early in this stage there are usually some manifestations of meningeal irritation. The superficial and deep reflexes are often found to be exaggerated. Soon the former may be difficult to elicit or may disappear while the knee-jerks are still active. Kernig's sign may be absent at the onset, but it usually manifests itself early in this stage in a modified form—a "suggestion of Kernig." When this early manifestation is detected, it calls for a thorough investigation of the case. As the premeningitis stage passes into that of established meningitis, so does Kernig's sign pass from the "suggestive" to the definite.

At first there may be mere discomfort on moving the head, or the neck muscles may only be tender to the touch. A degree of stiffness is next noticed, passing on to some limitation of movement, particularly the nodding movement. The patient's chin may not quite touch his sternum. When meningitis is established, the head is retracted.

(2) *The Stage of Established Meningitis.*—The classical symptoms of head retraction and Kernig's sign are now present. This stage does not fall within the present considerations.

Aids to Clinical Diagnosis.

An early case having been suspected on clinical grounds, a definite diagnosis can be arrived at by applying three aids: (1) Nasopharyngeal swab for direct examination and for culture; (2) total and differential white blood-cell estimation; (3) lumbar puncture and the examination of the cerebrospinal fluid.

(1) *Nasopharyngeal Swab.*—(*a*) Direct examination of a smear stained by Gram's method. In a meningococcus infection there is invariably an intense exudate of polynuclear cells. If the condition appears to be a pure infection of Gram-negative diplococci, the probability is that the case is a simple meningococcal pharyngitis. If Gram-negative diplococci are present

in a mixed infection, it is a point in favour of the condition being an early meningitis.

(*b*) Culture. A pure culture or nearly pure culture of meningococci favours a simple pharyngitis. A few meningococcus colonies in a mixed culture containing many pyogenic cocci, especially *Staphylococcus albus*, favour an early meningococcus meningitis.

(2) *Total and Differential White Blood-cell Estimation.*—Total count: This is of the greatest value and affords most reliable information as to the type of infection under investigation. The finding of a normal leucocyte count or a leucopenia at once dismisses the possibility of a meningococcus infection. In this way an influenzal meningismus can be detected by its associated leucopenia. In early cases of cerebrospinal fever there is invariably a definite leucocytosis. This has been found to lie between 15,000 and 21,000 cells. In one instance only has an early case of the disease been associated with a leucocytosis of under 15,000. In this case the first count was 11,000, within seven hours it was 19,200. Very rarely does a leucocyte count in a case of over 15,000 occur in a case of simple meningococcal pharyngitis; if it does, there is generally something definite to account for it, usually a superadded streptococcal infection of the tonsils.

A lumbar puncture should be undertaken at once in a case with clinical symptoms suggestive of meningeal irritation associated with a leucocytosis of 15,000 or over.

If with those symptoms there is a leucocytosis of under 15,000, the case should be kept under observation for forty-eight hours, a total white blood-cell estimation being undertaken morning and evening.

Differential Count: This is not such a constant guide. Early cases of cerebrospinal fever are generally associated with a polynuclear count of 80 to 90 per cent. A lesser percentage of polynuclears does not exclude the possibility of the disease.

(3) *Lumbar Puncture.*—It is better to conduct this under a general anæsthetic. The pressure of the fluid is raised, and more can be drawn off, which is all to the good, especially if the fluid is turbid.

In early cases the fluid may or not be under great pressure. It may be clear, or only slightly opalescent. In established cases of meningitis it is definitely turbid.

Anti-meningococcus serum must be given regardless of the appearance of the fluid. It should be given without waiting for the laboratory report on the fluid.

The question of the diagnosis has now to be decided. There should be no difficulty when the fluids are turbid or opalescent. A stained smear prepared from the centrifugalized deposit of the fluid will demonstrate the type of exudate. A lymphocytic exudate indicates generally tuberculous or influenzal meningitis. A search for the organisms will settle the point. If the exudate is polynuclear in type, meningococci will be found in every case of cerebrospinal fever.

A turbid fluid with no visible organisms is suggestive of a streptococcal or staphylococcal meningitis. In pneumococcus meningitis the pneumococci may not be difficult to find.

In all cases cultures should be taken from the fluid at the bedside and from the deposit of the fluid after centrifuging.

A diagnosis in the case of clear cerebrospinal fluid is not so easy. A cell-count may reveal a definite increase in their number. An examination of the deposit may reveal a few polynuclear cells and perhaps a few meningococci.

If no increase in cells is detected, the fluid should be incubated and the deposit examined microscopically, and, at the same time, cultured. Meningococci, if originally present, will have multiplied and may be detected microscopically or isolated in culture.

In the case of a clear fluid an examination of the patient within an hour or two after the injection of the anti-meningococcus serum will usually settle the point of meningococcus infection. When this infection is present there is a very definite reaction in the patient. There is an intense throbbing headache, neck stiffness and Kernig's sign are more evident. There is generally vomiting of a continued type. At the next lumbar puncture the fluid will be found to be definitely turbid, and meningococci may or may not be seen in the deposit, depending on the efficacy of the serum injected.

If the case is not meningococcal in origin there may be little or no reaction clinically. The fluid may show an increase in the number of cells at the next lumbar puncture, but the number may not exceed 300 per cubic millimetre. They are polynuclear in type.

A clear cerebrospinal fluid at an initial lumbar puncture is greatly in the patient's favour, but for diagnostic purposes it offers little opportunity to the bacteriologist to offer any definite opinion.

Acute Meningococcus Pharyngitis.

A discussion on the diagnosis of cerebrospinal fever would not be complete without a reference to the differential diagnosis between it and acute meningococcal pharyngitis. In the acute epidemic type of the disease, with its rapid train of progressive symptoms, the differential diagnosis is fairly evident and a total white blood-cell count may determine at once the necessity for an immediate lumbar puncture. The mild sporadic case, in its earlier manifestations, gives rise to a great deal of anxiety and uncertainty. It may be indistinguishable from a very acute catarrhal pharyngitis for twenty-four to forty-eight hours.

The only safe guide is to watch the degree of leucocytosis. If the total count exceeds 15,000, with no apparent superadded cause, a lumbar puncture should be carried out with no further delay.

As already stated, a pharyngitis case may hang fire for a few days with a fluctuating leucocytosis. Recently I watched a case brought into hospital

with headache, sore throat, neck stiffness of three days duration. The temperature was subnormal. He looked very toxic. There was a suggestion of Kernig's sign in both legs. A nasopharyngeal culture produced a growth of Type I meningococcus and *S. albus*. His blood estimations were as follows :—

Day of observation	Total count	Differential count: Polynuclears
1st morning	13,000	74 per cent
1st evening	14,600	69 ,,
2nd	9,200	79 ,,
3rd morning	15,400	69 ,,
3rd evening	14,800	76 ,,
4th	13,800	82 ,,
5th	9,700	68 ,,

On the third day he developed an inflammatory condition of both tonsils. Cultures from the throat revealed streptococcus colonies in large numbers.

In another case the leucocytosis rose to 18,600 cells for a similar reason. With the advancing leucocytosis the nervous symptoms subsided. For this reason a lumbar puncture was not done. The case cleared up completely in three days.

Early Apical Pneumonia.

Apical pneumonia in its earlier manifestations may readily be confused with cerebrospinal fever. As no cases of the former condition were encountered during the 1931 investigations, the disease was not cited in the general discussion on the differential diagnosis in Part I.

Two cases of this condition were seen within a week, early in 1932.

The first was a middle-aged warrant officer who gave a history of the sudden onset of headache and vomiting four days previously. His temperature was 102° F., pulse 120, respiration 26. The vomiting was of the continued type. He appeared extremely toxic. He complained of severe frontal headache, sore throat and tightness across the upper part of the chest. An examination of the chest revealed no signs of pulmonary involvement. Kernig's sign was absent.

A culture from the nasopharynx produced a heavy growth of catarrhal pharyngococci, but no meningococcus colonies were found.

There was a leucocytosis of 35,000 cells, 85 per cent being polynuclear.

A lumbar puncture showed a clear fluid, not under pressure ; 25 cubic centimetres were withdrawn and replaced by 20 cubic centimetres antimeningococcus serum. An examination of the fluid revealed the globulin and glucose content normal. The cell count was also within normal limits. No organisms were seen or isolated in culture.

The patient exhibited no general reaction after the administration of the serum. Next morning there was definite evidence of pneumonia at the apex of the right lung.

The second case was more confusing. The patient was brought into

hospital at night with the history of having vomited twice and then fainted on guard duty. He was seen by Major W. M. Cameron, O.B.E., Medical Specialist, York, who found the patient in a highly excitable condition. Temperature 102° F., pulse 104, respirations 24. The knee-jerks and other deep reflexes were greatly exaggerated. Kernig's sign was present in its most extreme form. The pupils were dilated. There was an intermittent hysterical internal strabismus of the left eye.

During the night the patient vomited several times. Next morning the nervous symptoms persisted in their exaggerated form. A culture from the nasopharynx revealed no colonies of meningococci.

There was a leucocytosis of 45,000 cells, polynuclears being 86 per cent.

At the lumbar puncture, twenty-five cubic centimetres of clear fluid were removed under slight pressure and were replaced by twenty cubic centimetres of anti-meningococcus serum.

The globulin and glucose content of the fluid was normal. The cell count was one cell per cubic centimetre. No organisms were seen or isolated in culture.

The patient exhibited no after-reaction to the serum.

Next morning his sputum was muco-sanguinous. There were early signs of pneumonia at the apex of the right lung.

It is interesting here to note that with a non-meningococcus infection there was no general reaction on the part of the patients after the administration of anti-meningococcus serum.

A Few Observations on Four Cases treated at the Military Hospital, York.

Early in 1932, several cases of acute nasopharyngitis, exhibiting signs of meningeal irritation, were admitted to the Military Hospital, York. Meningococci were isolated from each case. In those typed the organism was found to be a Type I meningococcus.

This created a "meningococcal atmosphere" and all cases were strictly watched for early signs of cerebrospinal fever. In addition, the medical officer in charge of the medical inspection room was asked to send cases complaining of headache and sore throat to the laboratory for investigation.

In this way four cases of cerebrospinal fever were detected in the early stages of the disease.

The blood and cerebrospinal fluid findings are recorded briefly below. In all cases antimeningococcus serum Type I (Lister Institute product, globulin solution) was administered at the lumbar puncture.

Case 1.—Leucocytosis of 21,000; polynuclears 89 per cent. Cerebrospinal fluid faintly opalescent. Globulin in excess, partial reduction of Fehling's solution. Cell count, 50, majority polynuclears. Several meningococci seen, all extra-cellular. Culture, sterile.

Case 2.—Leucocytosis of 18,200; polynuclears 85 per cent. Cerebrospinal fluid crystal clear. Faint trace of globulin but normal reduction of

Fehling's solution. Cell count of ten cells. In stained smears from the deposit the majority of cells appeared to be lymphocytes, but several polynuclear cells were found. Eight pairs of meningococci were found, after a prolonged search, six pairs being within one polynuclear cell, two pairs being extra-cellular. Cultures were sterile.

Case 3.—Leucocytosis of 15,000; polynuclears 60 per cent. Cerebrospinal fluid clear, globulin and glucose content normal. Cell count of two cells. No organisms seen or isolated.

The following day the cerebrospinal fluid was turbid, cell count of 1,550 cells. Occasional intra-cellular meningococci were observed. Cultures were sterile.

Case 4.—Leucocytosis of 11,000; polynuclears 76 per cent. After seven hours the findings were 19,200 and 66 per cent respectively.

The cerebrospinal fluid was clear and normal so far as could be ascertained.

Next day the patient was acutely ill. He lay in a state of semi-coma. There was neck stiffness and Kernig's sign was definitely positive. He refused to allow a lumbar puncture. The leucocytosis had risen to 26,000; polynuclears being 91 per cent. The following day he offered no objection to lumbar puncture. The was no coma but the patient felt acutely ill. There was a leucocytosis of 19,800 cells; polynuclears being 90 per cent. The cerebrospinal fluid was turbid, the cell count being 881 cells. No organisms were seen or isolated.

Nasopharyngeal cultures in each case produced meningococcus colonies in varying numbers; in one case only were they numerous. It is now greatly regretted that the meningococci isolated were not typed.

Permission was obtained to retain the cases for treatment at the Military Hospital, York.

The results obtained in the Command during the previous year with various brands of polyvalent anti-meningococcus serum were not encouraging. For this reason, and because the local strain of the organism appeared to be a Type I meningococcus, it was decided to give Type I serum a trial in the first case. That the serum was definitely specific was demonstrated by the fact that, although there was an intense cellular exudate at the second and third lumbar punctures, no organisms were visible or were isolated in culture. The case was intensely ill for three days. On the fourth day a definite improvement set in, which was maintained until the ninth day, when a severe serum reaction developed. He soon became cold, collapsed and pulseless. Cardiac stimulants and subcutaneous injections of adrenalin, 1 in 1,000, had little effect. An intravenous of 1 in 10,000 adrenalin was slowly given up to four cubic centimetres.

This produced a rapid change for the better, which was subsequently maintained by cardiac stimulants. Convalescence was rapidly established and the patient made a complete recovery, no after-effects of any description being detected.

Type I serum was given to the three subsequent cases. In each the reaction appeared to be specific, and only in one case were organisms found at the second lumbar puncture.

All cases, after being acutely ill for two or three days, made a complete recovery.

A daily examination of the fluid was made in each case. Below is a typical example:—

Day of treatment	Cell count	Percentage of polynuclears	Organisms seen
2	1,550	95	Occasional meningococci
3	370	85	None
4	475	80	None
5	140	80	None
6	145	60	None

No further treatment was given as the patient's clinical condition was now definitely good.

These four consecutive cases illustrate the immense importance of early diagnosis and the early application of specific treatment. Not only was the mortality rate *nil*, but no after effects were demonstrable in any of the cases.

In endemic areas every case of pharyngitis in hospital should have at least one total white blood-count performed daily.

Cases attending for treatment with symptoms of sore throat and headache should be detained for laboratory investigation.

The extra work entailed will be more than compensated for by the finding of a case of cerebrospinal fluid in its early, pre-meningitis stage, when a lumbar puncture can be undertaken with the reasonable hope of finding the cerebrospinal fluid clear.

There are two definite rules of action which should be adhered to in every suspected case of cerebrospinal fever:—

(1) Never omit to do a total white blood-count.

(2) When in doubt, lumbar puncture.

Summary.

(1) In Part I the investigation of twelve cases of cerebrospinal fever within the Northern Command of the Army is described. Eleven young soldiers and one young child were infected. The outbreak formed part of a generalized epidemic throughout the country.

(2) An endeavour is made to trace the sources of infection in the different cases. In two areas the main cause of cross-infection appeared to be due to overcrowding in canteens.

(3) Suggestions are put forward for future preventive measures. These entail a close watch on the carrier rate, from which much valuable information may be gained.

(4) The technique employed in the isolation of the meningococcus from the cerebrospinal fluid and from the nasopharynx is recorded. Difficulty was met with when attempting to type the various strains of meningococcus isolated. The typing serum available appeared to lack type specificity.

(5) The clinical investigation of cases is given in detail. When the results are set out in tabulated form the atypical nature of many of the cases is realized. The most constant features were headache and catarrhal pharyngitis.

(6) A definite leucocytosis was found constantly. It was invariably over 15,000 cells. (An exception is quoted in Part II.)

(7) The clinical aspect of the cases encountered is described. The mortality is recorded as fifty per cent. In the very acute cases it was one hundred per cent. Examples illustrating the different types of cases seen are given in detail.

(8) A differential diagnosis, so far as it affected the types of cases met with in the Command, is discussed. Many different types of infection are involved and reasons for their differentiation from cerebrospinal fever are given.

(9) The control of contacts and carriers, and the treatment of the latter, are considered. With simple treatment and outdoor employment, ninety-two per cent of the carriers were rendered non-infective within three weeks.

(10) The present custom of dealing with contacts is discussed and some doubts are cast on the necessity for our present-day procedure. It is considered that the bacteriologist's time might be more usefully employed in preventive investigation and also in the early detection of cerebrospinal fever among catarrhal cases in an endemic community.

(11) In Part II, the knowledge acquired is applied towards the establishment of early diagnosis. The criterion of early diagnosis is defined as the finding of clear cerebrospinal fluid at the diagnostic lumbar puncture. The mortality findings with cases diagnosed early and in cases in which the diagnosis was delayed, are quoted from actual experience. In early diagnosis the mortality was twenty-five per cent, while in late diagnosis it was seventy-five per cent.

(12) A plea for the detailed description of the earliest symptoms of the disease is put forward in the hope that an earlier diagnosis of cases may result.

(13) The aids to clinical diagnosis are described, the most important being a total leucocyte count and lumbar puncture.

(14) The difficulty of differentiating an early cerebrospinal fever from an acute meningococcal pharyngitis is discussed.

(15) Apical pneumonia is added to the previous list of cases in the differential diagnosis of the disease.

(16) Four cases diagnosed early in the disease are described and their treatment is briefly outlined. A Type I monovalent serum was employed. All cases completely recovered.

I am indebted to Colonel T. S. Coates, D.D.M.S., Northern Command, for permission to forward this paper for publication.

"ROPY BREAD."

By Major L. M. ROWLETTE, D.S.O., M.C.,
Royal Army Medical Corps.

A recent investigation by the writer on the above condition revealed the fact that little useful help is to be obtained from the scanty literature on the subject. Standard works on hygiene, if they mention the problem at all, are content with a mere statement to the effect that the condition is caused by the *Bacillus mesentericus*, and leave the practical worker to evolve his own methods for its isolation and identification. Again, many bacteriological textbooks only mention this organism to give it its apportioned place in the classification of bacteria, whilst the biological characters depicted in some books are at variance with the description given in others. These discrepancies are most marked in comparing English and American accounts, and, indeed, one of the latter proved very misleading in the early stages of the investigation. This suggests one of two possibilities, either the organism is very protean in its habits or else more than one strain is responsible for the development of ropy bread.

It is hoped, therefore, that the following account will be of some service to those who may in future be called upon to carry out a similar examination, and especially if this should have to be undertaken in some lonely outpost of the Empire where reference libraries do not exist.

"Rope" does not appear to be a common defect in British bread; this is undoubtedly due to the fact that the public purchaser, rich or poor, demands a loaf of the highest quality, both as regards materials and workmanship, and the baker producing inferior bread in these respects would find poor sale for his products; and so bakers are fully alive to the danger, and their efforts at prevention are generally successful. But even with the most rigid precautions the organism does sometimes find its way into a bakery and it is with the greatest difficulty and at a cost of much labour and anxiety that it is finally ejected.

The *B. mesentericus* which causes the condition gains access to the bread prior to baking, and may be introduced through any of the ingredients (flour, yeast or water [1]) or by accidental contamination of one or all of these by infected machinery or bakery premises. In the process of baking, the temperature in the interior of a loaf does not exceed 102° C., which is insufficient for the destruction of spore-bearing organisms. The following conditions are said to favour the development of rope [2]:—

(1) A high, humid atmospheric temperature. Doughs should be kept at 78° to 80° F.

(2) The use of too much yeast, thereby accelerating fermentation and minimizing the sterilizing effect of the fermentative process.

(3) Under baking, especially in hot weather.

(4) Lack of strict cleanliness in premises and machinery. Poor ventilation, especially in the proof room.

The appearance of "ropy" bread depends to a great extent on the degree of infection and the temperature at which the bread is stored—a hot, humid atmosphere greatly favouring development. In a certain case ropiness was very slight, and was discovered in one loaf only, more than a week after it was issued from the bakery. History does not relate why it had been stored for so long! The following is a description of advanced ropiness:

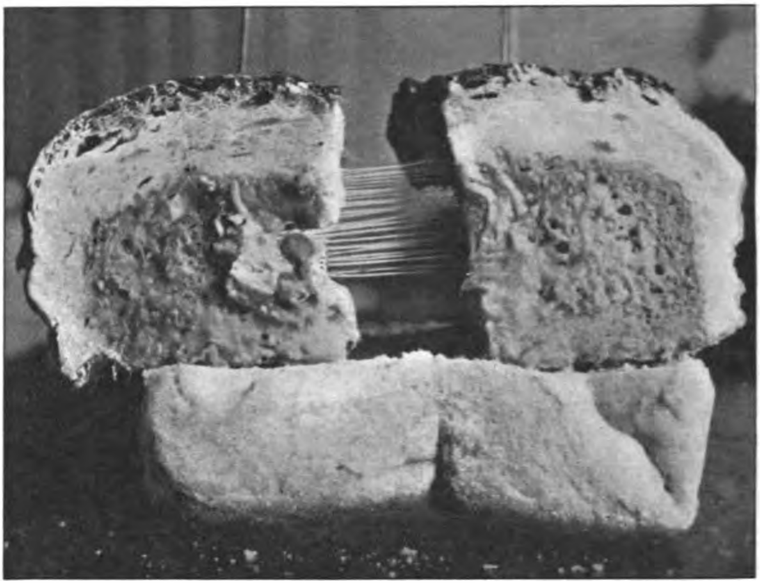

FIG. 1.—Photograph of ropy bread produced experimentally by a heavy inoculation with *B. mesentericus panis viscosi* and incubated at 37° C. for several days. Note the abundant "ropes" between the two upper separated portions and the glairy, semi-fluid slimy brown centre of cut surfaces.

"For the first few hours there was little or no change in the loaf at ordinary temperature, but after twenty-four hours, upon breaking the loaf, an odour not unlike ripe cantaloupe was noticeable. A few hours later, yellow or brown spots, with a soft sticky centre, began to appear, and within thirty-six to forty-eight hours, depending on temperature, the entire centre portion of the loaf became a semi-fluid sticky mass, totally unfit for food, and could be pulled out into long strings or ropes" [3]. In lesser degrees of infection, however, a close inspection may be necessary to diagnose the condition, and only a slight stickiness may be evident, as though underbaked, but if the tip of the finger is slightly moistened, so as to adhere to these doughy areas, long, fine, glistening threads, some as fine as a spider's web, may be drawn out to a distance of two or more inches. As development

proceeds, small yellow or brown areas may appear, and the bread has a characteristic sour, pungent odour (see fig. 1).

The causative organism, the *B. mesentericus*, commonly known as the potato bacillus, belongs to a very large, ill-defined group which is widely distributed in nature, and includes the subtilis, mycoides, anthracoides, megatherium, and anthrax bacilli, the last named being the only pathogenic species. Several varieties of the *B. mesentericus* are distinguished, depending mainly on the character of growth produced on potato medium. Thus, in addition to the common type known as *B. mesentericus vulgatus*, a brown variety *B. mesentericus fuscus*, a red variety *B. mesentericus ruber*, and a black potato bacillus *B. mesentericus niger*, are also described [4]. The strain responsible for ropy bread is known as *B. mesentericus panis viscosi*, and which, in the writer's hands, gave the following characters :—

Bacillus mesentericus panis viscosi.

Morphology.—A bacillus about 0·75 micron in width and varying in length from 2 to 7 microns, ends slightly rounded, motile, spores freely under all conditions. Spores are large, central, elipsoidal, and distend the bacillus.

Fig. 2.—Photograph of growth of *B. mesentericus panis viscosi* on agar plate. Note the wrinkling and the feathery spreading edges.

Staining.—It stains readily with the common stains and is Gram positive, but spore-bearing bacilli stain indifferently by this method.

Culture.—It grows very freely on all ordinary media. It is aerobic and a facultative anaerobe.

On *agar* growth is profuse, the colonies are dull, creamy white in colour

and opaque, with a granular mealy surface which is usually very characteristically wrinkled and with a spreading feathery edge (see fig. 2). Emulsification is rather difficult. A membrane is produced on the condensation water of the agar slope.

In *broth* there is general turbidity with a thick surface scum, and after some days' growth a coarse granular deposit.

On *potato* there is thick slimy growth, at first white, later becoming slightly greyish, surface shiny, in places coarsely wrinkled, and a wrinkled membranous growth heaped up on the inside of the tube.

On *gelatin* there is thick membranous surface growth with rapid liquefaction.

Biochemical reactions.—The bacillus produces acid in glucose, maltose, saccharose and sucrose.

Litmus milk is discolorized and peptonized. Indol — ; M.R. — ; Voges-Proskauer —

Viability.—Like other members of the group, this organism is very resistant to both heat and disinfectants. A prolific growth was obtained after the bacilli with spores had been heated for three and a half hours at a temperature of 85° C., while a temperature of 100° C. had to be maintained for twenty-eight minutes in order to effect sterility.

Vinegar in twenty-five per cent solution is generally recommended by bakers as being particularly efficacious in killing *B. mesentericus* on utensils, machinery, etc. It is also used for the prevention of rope where the flour is contaminated, and is mixed with the dough in the proportion of one pint to every barrel of flour. In this investigation, however, vinegar in ten per cent solution was found to be without apparent effect on the organism after three and a half hours' contact in artificial culture. The following table shows the effect of certain substances commonly employed for their disinfectant or cleansing properties:—

	Strength	Time of contact in hours								
		¼	½	¾	1	1½	2	2½	3	3½
Vinegar	10 per cent	+	+	+	+	+	+	+	+	+
Carbolic	10 ,,	+	+	+	+	+	+	+	+	+
Cresol	10 ,,	+	+	+	+	+	+	+	+	—
Ca(OCl)Cl	10 ,,	+	—	—	—	—	—	—	—	—
NaOH	10 ,,	+	+	+	+	+	+	+	+	—
Lime	20 ,,	+	+	+	+	+	+	+	+	+

+ Signifies growth on agar.
— Signifies no growth on agar.

The outstanding result is the particularly lethal effect of chloride of lime [Ca(OCl)Cl] which killed the organism and its spores in less than thirty minutes.

Isolation.—The organism is generally obtained in pure culture if inoculation is made direct from a ropy thread on to an agar plate.

In order to find out the origin of the contamination, cultures will have to be made from the ingredients (flour, yeast, water) and from all machinery and floors. This is best carried out by making a thin emulsion in sterile water of the various materials and from scrapings from machinery and floors. It was found to be an advantage to heat the emulsion to boiling point, thereby killing non-sporing organisms, and then plate out on agar plates. The growth of an organism having the above characters is then sought for, and as a final criterion a fresh loaf of bread from a healthy source is inoculated with a broth culture of the suspected organism and the development of rope awaited. To carry out this last procedure, the loaf is divided by two cuts into three portions with a sterile knife. One of these portions is then inoculated with several cubic centimetres of broth, spread over a few square inches of the cut surface. (The ordinary loop seeding is not sufficient, presumably due to lack of moisture.) The pieces are then brought into accurate apposition and are tied together in the original shape of the loaf. The cut surface not inoculated acts as a control. The whole loaf is then wrapped in paper so as to conserve moisture and is placed in the incubator at 37° C. If the organism is *B. mesentericus panis viscosi*, ropiness will begin to appear in twenty-four hours.

Pathogenicity.—The organism is non-pathogenic.

I am much indebted to Colonel D. S. Skelton, D.S.O., for his stimulating encouragement and interest, and for permission to forward this article for publication.

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DOWN SOUTH.

BY U. P. A.

II.—To Adam's Bridge.

(*Continued from p. 439, vol. lix.*)

Bombay.

Royal and Dower-royal, I the Queen,
Fronting thy richest sea with richer hands—
A thousand mills roar through me where I glean
All races from all lands.

In his "The Song of the Cities" Kipling reminds us that Bombay came under the English Crown as part of the dowry of Catherine of Braganza, on her marriage to Charles II. That was in the year 1661.

There is no doubt that Charles was gifted with a tremendous sense of humour. Nevertheless, it took him seven years to see the joke. In 1668 he transferred Bombay to the East India Company at an annual rental of £10.

Charles' prescience is emphasized in striking fashion when it is considered that it has taken us two hundred and seventy-one years to see the same joke.

In 1673 a writer recorded that the population of Bombay amounted to 60,000, and consisted of "a mixture of most of the neighbouring countries, mostly rogues and vagabonds." In deference to the present inhabitants of the city this observation is quoted without comment. Prominent amongst the residents nowadays are the baniyas of Guzerat, the marwaris of the Deccan, and our old friends the Parsis. There is also a strong colony of Pathans who provide the local newspapers with a good deal of exciting copy. By "beating it up" periodically, the members of this colony show their sympathy with the Brighter Bombay movement—a movement within the orbit of which is included a number of world-famous features such as Alphonso mangoes, duck, Malabar Hill, the Army and Navy Stores, and the arrival platforms at Victoria terminus.

The finest view of the city is obtained from—but you know that one.

Bombay's pre-eminence dates from the downfall of the Peshwa in 1818; and its abounding prosperity (until yesterday, at any rate) began in 1861, when the American Civil War opened the markets of Europe to Indian cotton.

During this tour the daily run sometimes exceeded two hundred miles, and the landscape was often monotonous. As a result—and especially with Georgina doing her trick at the wheel—I found ample time for

meditation on all sorts of subjects : on the significance of dates and their associated events, for instance.

In this matter, compare the difference between the individual and the herd.

It is commonly observed that, by a merciful dispensation of Providence, the individual gazes on the past through rose-coloured spectacles. His joys are lively, and even magnified : his sorrows are mitigated, and oft-times forgotten.

On the other hand, the society or the nation soon devalues, or ignores its triumphs and its glories; but its major defeats, and all the bitterness thereof, are engraven—dates included—on the hearts of the people.

A very few instances will suffice to show the profundity and importance of these reflections. Take, for example, the human race. In this case the dominant date is, of course, 100000 B.C., when Quaternary Man first made his appearance on this earth of ours. Or narrow the enquiry to a single country, England, which stands by 1066 : or Scotland, whose cherished date is 1513, the year of Flodden Field : or British India, 1661—as already mentioned : or France's 1870 : or that direful year in the history of America, 1871, when Mark Twain inadvertently told a horrified world that his compatriots had taken to "chawing gum." Germany and 1918 : Ireland and 1921: Russia and—but it is unnecessary to multiply these instances or even to seek for their causative factors. Individual psychology cannot always be analysed, but it can generally be sufficiently understood to be accepted. National psychology is full of insoluble puzzles and queer contradictions.

The genius of the Anglo-American group lies in its invention of the panacea of *co-operation cum compromise,* whereby committees, commissions and conferences, guilds, societies and leagues are set up for the purpose of tackling anything and everything.

But, so far, there is no League for the Abolition of National Commemorative Dates.

Surely this is a grave sociological omission, since it is in the highest degree likely that, were such a league to be formed, the future peace of the world would be assured for all time. As a corollary, it would, of course, be necessary to appoint a Committee for the Conversion of Geneva into a Memorial to the Bad Old Days (Undated).

This idea is so inexpensively simple and so obviously efficacious, that it is amazing that no one has ever thought of it before. But perhaps it is its very simplicity and efficacy which have caused it to be missed —as so often happens with a good thing.

To return to the Bombay Presidency : the hinterland is approached by a railway through the Bhor Ghat, and you can now travel from Bombay to Poona in a luxurious, fast electric train called the "Deccan Queen."

Undoubtedly the sapper is no ordinary mortal. Meeting him in the

course of the day's work, when it is necessary to beg for a pane of glass or for a washer for a tap, you encounter a person who is temporarily down and out. You feel that, in mentioning panes and washers, you are demeaning yourself and injuring one destined for higher and better things. Even such items as re- and mis-appropriations do little to remove the strain of routine official relationship. Except in the matter of major works—so often projected, so seldom consummated—the sapper always seems to be in, but never of, this dull, humdrum world.

Of what is he thinking?

Of this wonderful engineering feat, the Bhor Ghat railway, to be sure.

As we travel at speed, in security and comfort, along the edges of precipices or in the bowels of the earth, we realize that the charmingly named "Deccan Queen" is the child of a superman. Who but the sapper can claim to combine the rôles of scientist, craftsman and poet?

There is also a road up the Bhor Ghat. The less said about it, the better. It should be traversed on foot, or viewed from an aeroplane.

Poona, Deccan, boasts an interesting history and a proud place in the annals of the British in India.

In the eighteenth century the districts of Poona, Sholapur and Satara were the centre of the great Maharatta Empire founded by Sivaji. This empire stretched from Delhi to Mysore, and from the Punjab to Bengal. Three battles fought in the vicinity of Poona settled its destiny—the battles of Kirkee, Yeravda and Koregaon. In the year 1818, at Koregaon, a small British force consisting of 500 infantry, 6 guns and 300 horse unexpectedly stumbled on the Peshwa's main army numbering 20,000 men. A stubborn and bloody action ended in the decisive, and final, defeat of the Maharatta power.

It is of interest to note that the notorious Nana Sahib was an adopted son of the Peshwa, Baji Rao.

Modern Poona is somewhat overwhelming—at least, we found it so; but then, Georgina and I have spent most of our service in the back blocks, where the same evening frock may be worn till it is threadbare, and a tail coat hangs in the almirah until it is green: where the "Court and Personal" column is the only link between you and the Governor, and a hasty handshake, once yearly, is your only contact with the G.O.C. But at Poona we have seen the Governor and his lady in the flesh. We actually have had the privilege of conversing with them and with other august personages—by command, of course. And as for general officers—well, to them we have now become so habituated, that deference is neither based on awe nor bolstered up by eyewash. We have discovered that those who hold the right of the line in the "Table of Precedence" usually have sharp tongues and kind hearts, or hard hearts and gentle tongues; so that, by cultivating the more attractive organ and ignoring the other, it is not difficult to avoid the rocks and shoals. Occasionally you think you have

found a gentle tongue and a kind heart in one; but you can never be sure, and it is safer not to rely on an apparent combination. Perhaps the Poona climate has something to do with this failure to attain perfection.

Nothing need be said of the lower ranks of society, as they do not come into the picture—naturally. It has been said of the greatest of landscape painters that: "With Claude the background became the picture"; but great as this eminent Frenchman was, he would never have been able to put this principle into practice had he lived in the Poona of to-day. A background is of little importance when the cast is an all-star one.

When talking of a particular place, one is often asked the question: "What do you do there?"

This is not an easy question to answer, because its meaning is uncertain. Thus, if it be idly put, you merely reply: "The same as you do," since garrison life throughout India varies not in substance, but in degree. However, if it be in the nature of a challenge containing an implication such as, "What on earth do you find to do in that rotten hole?" your civic pride is electrified and your quick, emphatic answer is, "Everything the best people do, we do." At any rate, that is what you would have said prior to the flight from gold; but your post-flight answer varies according to your own mood and temperament. Perhaps the commonest now runs something like this: "Oh! well—I grin like a Cheshire cat and pretend I'm having a good time."

Poona is a difficult place to deal with, because it offers a plethora of pastimes and amusements, ranging from the Lido at the Lloyd swimming-bath to the British Museum atmosphere in the reference library. Between these extremes there are a hundred and one attractions, and you waste most of your time trying to decide what to do and what to leave undone. Those who remain in doubt would be well advised to follow the 'osses. That admirable institution, the Western India Turf Club, gives the doubters more than enough to do and, when it is all over, leaves them nothing with which to do anything else.

For an officer of the Royal Army Medical Corps, Poona has one serious drawback: it is impossible to shake off THE Corps for a single second: it is impossible to obtain the briefest respite, even in one's rare and precious spare moments.

If you arrive early at the Club, you run into "East Lynne," Act III. The play is about to be staged for the benefit of our Girl Guides. The producer (R.A.M.C.) intimates that, during rehearsals, your presence is an inconvenience. He requests you keep away. The Girl Guides Assistant Commandant supports his request. She, too, is R.A.M.C.

If you arrive late at the Club, the bridge secretary (R.A.M.C.) drops a hint to the effect that, if you do not propose to take a hand, you had better go away. The card-room is overcrowded with players, let alone spectators.

If you wish to play tennis, the secretary (R.A.M.C) informs you that the rabbits usually play on No. 7 court.

If you decide to play golf, the secretary (R.A.M.C.) tells you that, to-day, the links are reserved for a bogey competition confined to players whose handicap does not exceed 18.

If you go a-hunting, the local John Peel (R.A.M.C.) reminds you that your hunt subscription is overdue. The same gentleman—dressed, this time, like Paul Jones—warns you not to take out the "Seagull" before you have passed the committee's swimming test.

If you make up your mind that "Millbank" is a good thing for the Deccan Plate, the owner (late R.A.M.C.) tells you not to be a fool: the mare refused her bran mash last night.

If, in despair, you seek to bury yourself under a pile of books in the United Services' Library, the librarian (R.A.M.C.) digs you out. "We are about to purchase some new books," he says—"have you any suggestions to make?" "Yes: buy 'Save me from my Friends,' by Crookham Grosvenor." "That has been in the library for the last six months," he replies. Confound the fellow! too efficient: too knowing: and I must have fallen into that trap at least a dozen times . . .

You make for the open air. Your progress is barred by a lady. She is young and lissom. Her cheeks are roses. Her eyes are big and brown. Her hair, black and silken, curls over her little ears like wavelets on a mountain tarn. Her——

No, this is all wrong. Certainly, she is young; but she is graceful in a healthy muscular way: an athletic girl, this, with a clear, pink and tan skin, and sparkling blue eyes. No: blue-grey; and curling, golden hair; and her smile—ah!

But no matter: this lady (R.A.M.C.) holds you up with—"At last! What about that donation you promised for the League of Mercy?"

Lissom—roses—wavelets—sparkling? Bah—out for a blinded bat!

You resolve to join the I.M.S.; the Colonial M.S.; the Prisons M.S.; the M.S.R.N. or R.A.F.—anything—or secure a transfer to a one-man station, to-morrow.

Let us proceed to rejoin the car which, you may recollect (and provided you have an unusually retentive memory), was last seen debouching from Satara, the fortress-city of seventeen walls, towers and gateways. The degree to which the length and breadth of this great continent is steeped in the martial aspect of history is truly remarkable. In the Bombay Presidency these old forts raise their black, rocky battlements on every considerable hilltop. The very subdivision of the Presidency at once suggests war, thus: (1) Maharashtra—the country of the Maharattas. (2) Guzerat—the cradle of the Gujars. (3) Sind—the land of the Indus. Here, the numeral three supplies the key to the state-builders' intentions; and it becomes quite easy to visualize old Sivaji towering over his students at the Satara Staff College and addressing them something after this fashion:—

"Gentlemen—Re Hindustan No. 47, S.E. 1 in 500,000. Redland (Maharashtra) has declared war on Blueland (Guzerat). Greenland (Sind) is a neutral country which fears Redland's ambitions, and which is traditionally friendly towards Blueland. Will someone in the back seat kindly awaken Captain Brown? Thank you. A Redland force of all arms, strength approximately 8,000, crossed the Blueland frontier at—" and so on, until—"you will each hand in an Appreciation of the Situation at 10.00 hours to-morrow. By the way, I would again warn you that this war is *not* the last Great War: you can't dig trenches in rock. (*Subdued uproar.*) Less noise, if you please. At 11.00 hours to-morrow you will meet the Directing Staff at 'Ye Olde Toddy Palm'—X-roads, 974500. Sandwich lunch. The College 'buses will provide transport, so that no claims for T.A. need be submitted."

There is nothing new in this world.

A somewhat uninteresting run of 76 miles brought us to Kolhapur, the principal town of the native state of the same name. Like the capitals of nearly all the Indian princes nowadays it is, of course, an "enlightened" town; but woe betide the unlucky European stranger who is compelled by force of circumstances to spend a night there, for the dâk bungalow is one of the worst specimens extant. If the stranded traveller has the entrée to the palace guest-house, all is well: but if he has not, then heaven help him.

The reigning house of Kolhapur claims its descent direct from the great Sivaji. The family is traditionally pro-British and rendered us valuable assistance in the struggle of 1817-18. The present maharajah is a great sportsman and maintains a fine racing stable.

After a further run of 67 miles southwards, we arrived in Belgaum.

The Garrison Engineer, Kirkee, is the first person who merits honourable mention in connection with Belgaum. He is responsible for an excellent M.E.S. bungalow which is generously placed at the disposal of those who make polite application for the same. This bungalow is scrupulously clean, comfortably furnished, and well catered for by a butler who knows how to cook.

Long life to the G.E., Kirkee!

Having bedded down the auto and fathered and mothered Café and Noir, we both felt weary. We had been on the road for nearly twelve hours, and the journey had been hot, dusty and tiring. A mischievous inspiration prompted me to put the query: "And now, what shall we do?"

Georgina's answer was: "Bathe."

We bathed.

Again the query cropped up.

Georgina replied: "Dine."

We sat down to dinner.

For a third time the mark of interrogation raised its sinuous form, to

find Georgina at a loss. However, her tactics were sound: she counter-attacked. "I am tired of answering the same question," she said: "by way of a change, why not answer it yourself?" and as this was what I had been uneasily, but patiently, awaiting, I murmured—"What about a spot of beer?" It was a murmur; but it was a clear, distinct, intense murmur, like the murmur of a Bavarian brook whose waters, tumbling down the mountain-side, fill themselves with the clean air and radiant sunshine which eventually find their penultimate resting place in a prison of black glass.

It was a murmur; but it was a murmur full of meaning to the sympathetic ear.

Georgina cast at me one of those rare glances which intimate that perhaps I am not such a donkey as, at times, she is wont to think. She smiled; and the quality of the smile carried me back many years—to that blissful period of our engagement. I knew the beer was as good as consumed.

Alas! the G.E., Kirkee, had not provided for such a contingency; and the butler begged to be excused, as his principles would not permit him to keep a private cellar.

As Café and Noir were fast asleep, and so must not on any account be disturbed, Georgina prepared to set out for the jug-and-bottle department of the nearest canteen.

A heavy footstep was heard in the verandah, a bulky form filled the doorway, a hearty voice hailed us with: "Hello! What are you good folks doing so far from home?" and five minutes sufficed for the procuration of two quart bottles from the officers' mess of the Senior Officers' School. Not all fairies are slim, nimble little things with wings.

Why should this golden nectar be confined in receptacles so sombrely tinted and so hideously shaped? And why should these receptacles be defaced by labels of the crudest and ugliest kind?

Why should this wonderful beverage be taxed until it is reduced to a ghost of its old-time self and is put out of reach of the only man who counts—the common man?

Surely this peer of liquids deserves more kindly treatment from those whom it edifies and sustains ere it is consigned to its final destiny; but who ever heard of a brewer-poet or a treasury with a soul?

Despite these disturbing thoughts, our sleep was deep and refreshing.

The scenery in the immediate vicinity of Belgaum is attractive, and the cantonment is situated so as to benefit from any breeze which may be blowing. Colloquially, it is "a good station." The fort is worth a visit. The activities of the place are centred in the Senior Officers' School and the Army School of Education. The latter has a wing devoted to C.e.i.a. W.r.a.e. Presumably this wing is doomed to extinction at an early date, consequent on the recent international agreement to limit the arms of belligerents to l.p-s.i.k and p.w.e.-p.f.s. Incidentally, it is not generally

known that, by the same agreement, the transport of armies has been limited to bile carts. This decision has caused much perturbation and excitement in high quarters, because, so far, no one has discovered what these vehicles are. Unfortunately, the medical services have come in for a good deal of odium on this account: it seems that the conveyances in question were mentioned for the first time in history in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS for March, 1932. Meanwhile, a Commission, Bile Carts, for the Identification of, has been appointed. It is to be hoped that the philological and transport experts who compose this commission will be able to elucidate the mystery; but the prospects are gloomy.

We left Belgaum at 7 a.m. on March 7.

Although the wanderers who belong to the British Army enjoy many sights and sounds—and smells—denied to their stay-at-home brethren, still their nomadic existence deprives them of numerous amenities associated with the settled life. Perhaps the absence of good music is the want most keenly felt; and next comes literature. It is impossible to listen to an opera or an orchestra, because these institutions are not to be found within cantonment limits; and it is impossible to build up a library, because transport difficulties bar the way. Perchance the advent of bile carts may cure this evil; but, in the meantime, books are bought, cherished for a while and then—and inevitably—jettisoned.

And yet, despite the attenuated state of my library, I have been able to collect quite a number of apt and delightful references to "Morning": not the belated, stuffy morning when the eggs and bacon congeal under the blast from a powerful fan, but the morning which is permeated by the roseate hues of early dawn.

I must refrain from quoting any of my charming references to virgin morn, because nothing is more admirable than to practise what you preach —and I dare not preach about early rising. Nevertheless, when force of circumstances (which, in this particular instance, include Georgina) compel you to quit your couch at 6 a.m. and take to the road by 7 a.m., you realize that your habitual sloth has robbed you of something which will never return, and for which there is no substitute.

If you have the courage to think of the enormous number of days on which you have neglected the early morning, you curse—and lie abed the following morning.

Hence, in the feeble hope of obtaining a convert, I would impress on you, dear reader, the joy of being out and about on an Indian morning between 7 and 10. It is then, and then only, that the air is cool, fresh and invigorating. It is then—if ever—you declare that life is really worth living.

How anyone—myself included—can lie in bed, asleep, during these magical early morning hours passes my comprehension.

The town of Dharwar, forty-seven miles from Belgaum, is of some size

and civil importance as the headquarters of a thriving district. The place figures prominently in Maharatta history, and at one time it was garrisoned by British troops. However, these remarks also apply to most of the bigger towns and villages passed on our journey south, for armies marched and counter-marched over this countryside for centuries.

Twelve miles further on is the busy town of Hubli with its big railway workshops. It is the site of an old English trading factory which was plundered by Sivaji in 1673.

At Trimulkop, a road on the right leads, via Sirsi, to the famous Gersoppa Falls on the Sharavati River. These falls and their surroundings will be mentioned later on.

We pulled off the road as it topped a rise and had tiffin in the shade of a clump of big trees. It was cool, with a pleasant breeze. These are, of course, silly, boring details to set before one who was not there; but they have a purpose, viz., to introduce the subject of the wayside meal. It is an important subject because, first, you must have nourishment; second, you must not waste time; and third, the weight and bulk of articles carried in the car must be kept down to a minimum. On these journeys our tiffin hardly ever varies, and—curious fact—we never seem to tire of its ingredients.

Two thermos flasks: one containing hot, strong coffee, and the other hot milk. Each flask is capped by a china mug.

A third thermos, specially made for carrying butter. In a flask of this kind we have kept butter—and it has remained fresh—for as long as fourteen days; something of a feat, in southern India's plains, in mid-March!

Biscuits, e.g., "Vita-Weat," cheese in silver foil packets, cake or chocolate and fruit, and two knives.

All these things pack into two small leather cases each measuring 11 by 8 by 4 inches.

However, what is one man's meat is another man's poison; and if you complain that there is no room either for hard-boiled eggs or for onions you will have to devise your own stowage scheme.

Harihar is the next town of any size. Authentic evidence points to the existence of this town as far back as the thirteenth century: but legend goes much further back than that, for the name commemorates the coalition of Vishnu (Hari) and Siva (Hara). It is curious to think that a modern political expedient is rooted in the primeval East. In the story of Hari and Hara it is related that the god and goddess united in one form, in order to encompass the destruction of a giant who had won from Brahma the gift of perpetual life—which gift the blackguard used for the torment of gods and men. One wonders if the giant was named Sona....

Here we crossed the Mysore border, and paid our first road toll.

On all the roads there are numerous toll-gates at which motorists are mulcted anything from four annas to one rupee a time. In a long day's

run the ransom exacted by this mediæval form of blackmail amounts to a total of from twelve to fifteen, or more, rupees.

The roads in this State are indifferent, bad or exceedingly bad; in fact, in this respect, Mysore runs the Bombay Presidency a very close second.

What purpose is served by these vexations and costly tolls? Of course the State treasury officials could answer that question: the motorist could only name the object to which the payments are not devoted.

It takes a long time to explode some myths, and especially is this so in the East. The myth that a motorist is, *ipso facto*, a millionaire, is one of them, and it is one to which the Bombay Presidency and Mysore State will cling long after everybody else has discarded it; and the notion that springs are absolutely unbreakable is, of course, typical of the mind which is devoid of any mechanical sense.

Chitaldroog nestles picturesquely amongst broken ground, and affords a welcome change from the somewhat monotonous scenery to the north.

Here is the first appearance of curious rock formations which, later on, become common features of the landscape. These formations are largely composed of huge, rounded boulders whose smooth, tinted surfaces present few fissures, angles or jagged excrescences such as one usually sees in rocky hill country. Rising abruptly out of the plain you notice a grey battle-cruiser steaming full speed ahead, the displaced waters tumbling from off her sides in foaming cascades; or a lion couchant with flowing mane and tapering tail complete; or an elephant, a whale, or even a gigantic effigy of a recumbent, mail-clad crusader, his dog at his feet.

It is the dressed, or carven appearance which gives to these great outcrops the semblance of familiar things.

Chitaldroog contains a fine example of the old forts of this district. The way in which the several parts of this fort rest on, and merge into, the massive rocks is quite beautiful.

We arrived at Hiriyur, 168 miles south-east of Belgaum, at 4 p.m.

The village stands on rising ground, and a breeze was blowing; but it was a hot breeze, and of shade there was none.

The dâk bungalow was fairly large and airy. Also, it was unusually clean and tidy. The members of the staff—grandfather, father and small boy—were present and correct. In short, there was every sign that our arrival had been expected and prepared for, and Georgina and I concluded that a rare thing had happened, viz., that our warning letter had been received.

"Salaam, Khansamahji. Let us have tea now, then baths and dinner at 7.30 p.m."

Grandfather—who looked like a moth-eaten Abraham—stared blankly and replied: "Your honour, salaam; but here there is no fuel, no tea, no milk and no dinner. Also, by the will of Allah, there is no fresh, clean water."

Father—another venerable Old Testament Mussulman—added: "Besides, we have no funds: not a pie, alas!"

"But you must have received my warning letter five or six days ago."

The staff, in unison: "Ohé, protector of the poor, no such letter has come."

There is only one way in which to ensure an adequate reception at these bungalows, and that is to send an insured letter, well beforehand, together with an advance fee of about five rupees. It is true that these people are poor, and therefore dare not run the risk of being "let down." An order for dinner arrives by post, the necessary foodstuffs are bought and—the traveller fails to turn up. In such a case it is 100 to 1 that, in these days, the said traveller will forget (*sic*) to send an explanatory letter and money to recompense the Khansamah for his outlay. It is annoying to find that, on arrival, nothing is ready; but it is not fair to put all the blame on the D.B. staff.

Having suffered from this sort of thing before, we were prepared. A scratch meal was forthcoming from our own resources, much to the relief of Abraham, Isaac and Jacob.

Isaac acted as waiter. Georgina disapproved of the condition of a plate which was put before her. Isaac removed the plate, and—behind Georgina's back—blew on it and wiped it on the tail of his shirt. I kept silent: had I said anything, it is probable that something worse would have occurred. Georgina enjoyed her dinner and suffered from no ill after-effects.

Georgina slept on a bed of boards, and I on an iron bedstead with a part-worn spring mattress. The springs were intact except at the vital places—under the shoulder and pelvic girdles—where they either sagged or protruded. Sleep was conducted in fifteen-minute spells: fifteen minutes of unconsciousness and fifteen minutes of movement and massage, alternately.

At 1 a.m. a powerful saloon car arrived. Its horn hooted, its engine roared, its headlights illumined the dark and its principal occupants—a lady and an ayah—descended to earth and uttered loud shouts, commands, exclamations and objurgations. The third occupant—the chauffeur—said nothing, poor man. Abraham, Isaac and Jacob were hard put to it to cope with the invasion: the flurry and haste of the big outside world seldom ruffled their calm backwater: they disliked, and were upset, by the whole business.

By 1.30 a.m. no sounds were to be heard save the creaking of boards and the squeaking of springs at fifteen-minute intervals.

At 5.30 a.m. the lady of the powerful car prepared to go, and for the next half hour the air again quivered with excitement and noise. The car went off at 6 a.m. and we arose.

Neither Georgina nor I looked our best that morning.

Café and Noir turned up smiling, having spent the night in profound,

continuous slumber. Fortunate is the peace of innocence, wonderful is the adaptability of Youth !

We were not a mile out of Hiriyur before the precious pair were fast asleep once more.

This was a day of laughter and merriment. Masses of white cumuli coursed along the upper strata of a sky which was brilliantly blue; but although the sunshine dazzled, a cool breeze blew across the highway, tempering the heat and scattering the dust out of harm's way. The people were out in force and mostly on foot: a care-free, laughing, chattering throng. The men wore spotless white garments, and small, coloured pugris with edgings of gold braid. The women were bareheaded, but in their hair were entwined natural flowers, arranged in the neatest and gayest fashion imaginable. Their dresses and saris were of the hues beloved of Brangwyn—vivid reds, yellows, blues and greens: a brave sight. Obviously the whole Hindu countryside was on holiday bent.

We passed a man on a bicycle. His pump was fixed in an original manner amongst the spokes of the front wheel, and in the same flat plane as the wheel. This gave the rider and his machine quite a reckless, debonair appearance.

We approached a led bullock. The animal tried to break away, and, as we drew alongside, became almost unmanageable. But the man in charge was equal to the emergency. With cool dexterity he cast a half-hitch of the leading rope over a milestone which happened to be on the spot, and the bullock was brought up short. You may see the same thing done with a sailing boat on The Broads.

South-east of Tumkur we ran up and over a series of wooded hills. Here the greenery, the rocks, and the light and shade framed the gaily coloured procession to perfection.

Even Café and Noir awoke at intervals, and waved a patronizing salutation in response to the joyful shouts of the numerous children who accompanied the festive crowds.

It is unlikely that Messrs. Freud, Adler, Jung and Co., would make much of a livelihood in these parts; but wait a bit : it will be different when everybody becomes rationalized, standardized, civilized, emancipated and enlightened. Of that there is no doubt.

Great are the benefits of Westernization.

At noon we entered Bangalore, having covered a distance of ninety-eight miles.

(*To be continued.*)

Editorial.

THE STATE OF THE PUBLIC HEALTH.

THE Report on the State of the Public Health for 1931 is the seventy-fourth of the series, and is presented by Sir George Newman to the Minister of Health. It is on the usual lines, records the work carried out by the Ministry, and contains the ordinary official records and statistics which are required to estimate the state of the public health.

Sir George Newman considers that as the result of the Public Health Service we are getting national health, a purchasable commodity. We are buying *survival, health* and *capacity*.

In 1871-80, the expectation of life at birth was 41 years for a boy and 44 years for a girl. To-day it is 56 for a boy and 60 for a girl. The expectation of life at birth in two generations has increased by not less than 15 years.

The death-rate of infants under one year is regarded as a good index of national well-being. In 1871-80 the infant mortality rate was 149 per 1,000 births; in 1931 it was 66. The mortality from tuberculosis is also a useful indication of the general health of the population. In 1871-80 the country lost 2,231 lives from consumption for every million of the population; in 1931 the loss was only 685 per million, a reduction of nearly 75 per cent.

Sir George Newman controverts the statement often made that though there has been a definite decline in death-rates, sickness is as prevalent as ever, or even more prevalent. He points out that though we have no official records of sickness which is not fatal, except that of infectious disease and certain forms of industrial poisoning and accident, the English people do not behave like, and do not appear to be, a sick or invalid people.

The idea of increasing sickness seems to be derived from the sickness returns of the insured population. It is true that the loss of time from sickness and disability in organized industry, amounting to three weeks per insured person yearly, shows no signs of declining; but an investigation has shown that in the last few years there has been an increase in claims for benefit rather than an actual increase in disease.

Sir George Newman believes that the establishment and expansion of the Public Health services has led to the creation and maintenance of what a former Prime Minister described as a "national minimum" of health requirement, a positive health standard. If we allow this standard to be lowered, we permit the introduction of avoidable and definite risks to the survival and capacity of a people.

The official annual expenditure on Public Health of local authorities in England and Wales on all medical and allied services met out of public

funds, i.e., Exchequer grants and local rates, is £57,370,000. Of this sum, £26,200,000 are spent on the public medical services, and £31,110,000 on environmental services, viz., housing, water supply, sewers and sewage disposal, and collection and disposal of house refuse. The figures are net, the actual cost to the State after the deduction of money received in payments. Voluntary funds and resources are excluded, and also expenditure on baths, wash-houses, street cleansing, and parks and open spaces. Sir George Newman considers that compared with other forms of national expenditure, the large sums expended on public health bring in a justifying dividend—a dividend of life, health and capacity.

The enumerated population of Great Britain in April, 1931, was 44,790,485. The population of England and Wales, estimated in the middle of 1931, was 39,988,000. There has been an accelerated fall of the birth-rate since 1921, but the improvements in rates of mortality have just enabled the population to maintain the position. The Registrar-General points out that this compensation cannot continue and by the middle of the century will have attained or passed its maximum.

The chief causes of death were: diseases of the heart and circulatory system, 255 per 1,000 deaths; bronchitis, pneumonia and other respiratory diseases, 130 per 1,000; cancer and malignant disease, 121 per 1,000; diseases of the nervous system, 82 per 1,000; all forms of tuberculosis, 73 per 1,000. This statement of the causes of death simply indicates the killing diseases and has obvious limitations. If the period of man's normal working life, viz., from 15 to 65 years of age, be considered, the arrangement of the certified causes of death becomes different. Diseases of the heart and circulation still keep the first place, but all forms of tuberculosis now take the second place; then comes cancer, followed by bronchitis, pneumonia and other respiratory diseases.

In 1931 the number of road accidents was 165,112, compared with 57,481 in 1921. The number of preventable deaths rose from 5 per 100,000 of the population in 1901 to 16 per 100,000 in 1931. The investigations of the Industrial Health Research Board are making it clear that the psychological factor in the ætiology of accidents, not only accidents on the road but in the factory, is important, and that accident-proneness can be diagnosed by clinical and experimental methods. The time seems not far distant when an examination from this aspect of persons seeking licences to drive mechanically-propelled vehicles will be regarded as a natural precaution.

There is evidence of progress in maternity and child welfare work. The puerperal death-rate was 4·11, the lowest figure recorded since 1927, and it is hoped that this marks the beginning of a more substantial reduction in maternal mortality, which is both possible and practicable. The Maternal Mortality Committee have completed their investigation of 5,800 maternal deaths and consider that at least half the deaths due to childbirth in England and Wales could have been avoided if due fore-

thought had been exercised by the expectant mother and her attendants, and a reasonable degree of skill had been brought to bear upon the management of the case, and the facilities for treatment now available had been used. The Committee found that 18 per cent. of the maternal deaths due to child-bearing were caused by sepsis following normal labour.

Attention has recently been directed to the possibility of infection due to carriers of hæmolytic streptococci—doctors, midwives, attendants, or the patient herself. It was assumed that this danger was largely confined to maternity institutions and that an increase in sepsis might be associated directly with an increase in the number of maternity beds. It has been shown, however, that this is a risk of domiciliary as well as institutional practice. This matter was fully discussed in the Report of the Maternal Mortality Committee and it seems clear that the elimination of this risk requires specific and systematic precautions which have been lacking in the past. As a result of the recommendation by the Maternal Mortality Committee, the Ministry of Health and the Medical Research Council have arranged that the services of Miss Dora Colebrook, who is working in the new laboratory of Queen Charlotte's Hospital at Hammersmith, shall be available for the assistance of Medical Officers of Health in connection with special investigations of outbreaks of puerperal sepsis.

Sir George Newman hopes that the need for national economy will not prevent maternity and child welfare authorities from considering the ways in which the supervision of the health of the pre-school child may be improved. There is a gap between the infant welfare and the school medical services. After the second year of age excessive morbidity becomes the predominant issue and unless the pre-school child can be treated promptly for minor ailments, its general health may be seriously damaged. It is noteworthy that at the first school examination many children are found to be suffering from defects and ailments which might have been prevented by early treatment. Much may be done to aid the mothers through regular home visiting by a trained and competent visitor. The mother should be advised to bring the child to the Child Welfare Centre, say once a quarter, for ordinary consultation, or preferably for a medical session if there is one. In many areas the School Clinic is available for the treatment of defects of the throat, eyes, ears and teeth, when these cannot be dealt with by a private doctor. It is particularly after measles and whooping-cough and other acute illness that the child requires supervision to see that any complication is not neglected.

In the Section of General Epidemiology, further information is given about the persistence of the paratyphoid bacillus in the sewage of Epping to which allusion was made in the Report for 1930. Sir Alexander Houston showed that during the whole of 1931 the effluent discharging into a tributary of the River Lea contained *B. paratyphosus* B. The counts varied from 1 in 3 cubic centimetres to 355 in 1 cubic centimetre ; on only

seven occasions during the year were negative results obtained on culture of 3 cubic centimetres.

There was no outbreak of clinical paratyphoid fever in Epping to account for this persistence of the specific bacteria in the sewage, and the question arose whether in other districts where there had been diseases of the enteric group there might be similar persistent contamination of the sewage. Investigations were made at Havant, Stoke-on-Trent, Ipswich, Wroxall (Isle of Wight), Consett and Daventry. At Havant, eighteen children who, in June, 1930, had drunk water from a stream contaminated with the effluent of the Havant sewage works developed enteric fever. Specimens of the Havant effluent collected on January 8 and 29, 1932, were found to contain sixty and forty typhoid organisms respectively per cubic centimetre. At Stoke-on-Trent in October and November, 1930, there were fourteen cases of enteric fever of water-borne origin. In January and February, 1932, *B. paratyphosus* B was found in one sewer of the invaded area but *B. typhosus* was never detected. In Ipswich during July and August, 1930, there were fifteen cases of enteric fever of undetermined origin, but in January, 1932, neither *B. typhosus* nor *B. paratyphosus* B was found. Dr. Scott, however, detected *B. aertrycke* and *B. Newport* in one of the specimens of sewage. At Wroxall there were twenty cases of paratyphoid B fever in June, 1931, and *B. paratyphosus* B. was found in the sewage outfall and in the River Yar. At Consett there were sixty cases of paratyphoid B in July and September, 1931, and in December the specific bacillus was found in the sewage.

These results confirm the opinion expressed by the Royal Commission on Sewage Disposal that treated sewage effluents, though good when judged by chemical and physical tests, are liable to contain large numbers of micro-organisms of intestinal derivation.

Sir Alexander Houston does not think it is necessary to conjecture any multiplication of the paratyphoid bacilli in the soil at Epping. He found paratyphoid bacilli in the sewage effluents died fairly rapidly under conditions of storage. None of the "uncultivated" bacilli could be found in 500 cubic centimetres after three weeks' storage, and they usually died in one week. Many more paratyphoid bacilli were found in the sewage before treatment on the land. If the soil on the sewage farm had acted as a culture medium more paratyphoid bacilli and more coli should have been found in the effluent as compared with the sewage.

There is no doubt that the persistence of the organisms of the enteric group in sewage is connected with the existence of undetected cases of enteric diseases. The paratyphoid group of fevers is now more prevalent, much less severe than typhoid fever, and failure to recognize these cases is undoubtedly common. These experiences emphasize the necessity of adequate supervision of water supplies likely to be contaminated by sewage.

Attention has been drawn to this failure of diagnosis in previous Reports of the Ministry of Health, and it is hoped that more use will be

made by practitioners of the means of diagnosis now gratuitously provided by Local Sanitary Authorities. It is thought that a *prima facie* case has been made out for the diagnosis of typhoid-infected individuals by the skin reaction proposed by McKendrick. But further research on the reaction as a method of detection of typhoid carriers is considered desirable and it is suggested that observations might be made in mental hospitals where enteric carriers give serious trouble to the medical staff.

The outbreak of typhoid fever at Malton, in Yorkshire, in 1932, stresses the importance of early diagnosis of enteric fever. On September 23, a youth suffering from "pneumonia and diarrhœa" was admitted into the workhouse infirmary at Malton. He was not regarded as a case of typhoid fever for several days and remained in the infirmary until October 26, when he was removed to an isolation hospital outside the district. After October 22 other cases of typhoid fever began to be notified in Malton and up to November 17 there were 245 cases with fourteen deaths. The drain from the workhouse was found to be gravely defective at its junction with the sewer. Its contents had been deposited subterraneously on land contiguous to the low-lying well and to the pumping station by which the well-water was conveyed to the reservoir.

The investigations of the Ministry of Health leave no doubt as to the cause of the outbreak at Malton.

In the Epidemiological Section there is also a short account of the history of immunization against diphtheria. The International Conference which met in London in June, 1931, to consider questions of diphtheria and scarlet-fever prophylaxis, after reviewing the results of two years' inquiry, were in favour of the wholesale immunization against diphtheria of children after one year of age.

In London the results of immunization of children in the old Poor Law schools of the London Boards of Guardians have been so successful that in February, 1932, the Managing Committees of ten other institutions with accommodation for 4,500 children asked the London County Council that the scheme of immunization might be applied to their schools, and this is now in progress.

In the Report of the Health of the Navy for 1930, the Medical Director-General says that diphtheria in the Greenwich Hospital Schools cost £10,000 between 1921 and 1928, but, thanks to the Schick-testing and immunization there are now no cases, and to maintain this condition costs less than £30 a year.

For the application of immunization to the child population it is essential that the materials used should be effective and innocuous. There is little doubt that with the safeguards supplied by the provisions of the Therapeutic Substances Regulations these conditions will be met and diphtheria, like smallpox and enteric fever, can henceforth be regarded as a preventable disease.

During the past sixty years the death-rate of scarlet fever has declined

enormously, but the Registrar-General has shown that the decline in the death-rate is due not to a lessening incidence of the disease, but to a benignant change in the disease itself. After the epidemic of 1921, a committee of medical officers of the Ministry reviewed the whole position, and concluded that for uncomplicated cases in hospital there was no necessity to prolong the period of detention for more than four weeks, and that whatever may have been the influence of hospital treatment on the prevalence of scarlet fever in former years, the incidence in recent times appeared to show no marked reduction as a result of hospital isolation or, indeed, of any other method of public control. Since the publication of the committee's report, two lines of investigation have been followed, one epidemiological, relating to hæmolytic streptococci, and the other clinical, relating to the use of antitoxin.

The chief use of antitoxin is to relieve toxic symptoms during the acute stage of the disease, and for this adequate doses must be given as early as possible. After the third day of disease Craig has shown that the treatment has little value.

It has been noticed that patients treated with antitoxic serum are more prone to relapse. In second attacks or relapses of scarlet-fever, a different type of streptococcus from that causing the first attack is often present. Griffith and Gunn found that in 100 patients nursed in open wards 50 per cent showed a change of type of the infecting streptococcus during their stay in the isolation hospital. In those patients who failed to develop antitoxic immunity as indicated by a Dick-positive reaction, the change of type coincided with a second attack of clinical scarlet fever. It is thought possible that the administration of antitoxin may hinder the acquirement of active immunity to the toxin ; as if the toxin is immediately neutralized the body does not produce immune substances.

In the Report for 1930, reference was made to the observations of Griffith and Alison, who have shown that four types of *Streptococcus pyogenes* appear to be responsible for cases of scarlet fever. The proportions have been remarkably constant in the 700 cases examined during the past five years. Griffith has recently observed that extensive outbreaks of tonsillitis, with severe complications, but without rashes, have been caused by Types I and II. The rash is stated to be absent because these types are deficient in normal capacity to produce the "erythrogenic" or Dick toxin.

In addition to the four chief types a large heterogenous group of streptococci has been found to cause (*sic*) scarlet fever. Certain of thesehave been identified in widespread outbreaks of tonsillitis and otitis media in schools and have also been met with in severe cases of puerperal fever. Sir George Newman states that these are all reactions to the invasion of the body by members of the same bacterial species, *Streptococcus pyogenes*, though the nature of the reaction varies according to : (1) the toxigenicity of the particular streptococcal type ; (2) the degree of antitoxic and anti-bacterial

immunity possessed by the infected subject and (3) the site of entry of the infecting agent. He writes that "evidence is accumulating that the identification of the serological type of *S. pyogenes* is capable of co-ordinating a variety of different illnesses epidemiologically, the prevalence of a particular type in a community explaining the incidence in it of otherwise unassociated cases of all these different clinical entities. The question of sero-therapy on the basis of this new knowledge is one that is as yet almost completely unexplored."

In connection with this subject it is well to bear in mind that the late Sir Frederick Andrewes came to the conclusion that no one serological form of streptococcus could be credited with the causation of scarlet fever. He thought they were in a constant state of flux.

Clinical and other Notes.

A MODIFICATION OF THE "HORROCKS BOX."

By Major T. B. NICHOLLS,
Royal Army Medical Corps.

This apparatus, which was originally designed for the Service water cart, has been extensively used in India for estimating the amount of bleaching powder to be added to much larger quantities of water, such as water works, large tanks, etc.

The very frequent complaints of chlorinous taste led to the following investigations, which were carried out to ascertain if Horrocks' method were sufficiently accurate and suitable for the testing of these larger bodies of water.

Horrocks' method differs from that of Sims Woodhead, in that the bleaching powder is measured by bulk, instead of being weighed.

It was to this step of the process that attention was first directed.

Fifty weighings from the same tin of bleaching powder were made to determine the weight of a scoopful of powder, and these showed very varying results, the minimum being 1·293 grammes, and the maximum being 2·298 grammes.

The amount of bleaching powder necessary to show free chlorine after half an hour was determined by the Sims Woodhead method as well as by Horrocks' method on untreated canal water, with a bleaching powder containing 32·9 per cent of available chlorine.

The dose of powder, as ascertained by the Sims Woodhead method, was 9·0 pounds bleaching powder per million gallons, which equals 0·29 chlorine p.p.m.

By the Horrocks method, the minimum dose, as measured with the scoopful weighing 1·293 grammes, was equivalent to 25·8 pounds bleach per million gallons (0·894 p.p.m.), while the scoop which held the maximum, i.e., 2·298 grammes, gave the result of 45·8 pounds bleach per million gallons, or 1·506 p.p.m.

This shows that the scoopful varies so much that the dose of bleach will range from twenty-five to forty-five pounds per million gallons, whereas the correct dose as determined by the more accurate Sims Woodhead method was only nine pounds.

This discrepancy in the results is quite sufficient to account for the chlorinous taste so frequently the subject of complaints, and the excess bleach used is the cause of unnecessary expenditure.

A simple calculation will show that the wastage of bleach in a water works delivering one million gallons daily, would amount to over £300

per annum if a scoop showing the maximum error in weight were in use daily.

The Horrocks apparatus also suffers from the additional disadvantage that it will not estimate a dosage of less than one part per million.

While this gives a margin of safety with the water cart on active service conditions, it has been found that very many of the waters available in cantonments do not require so large a dose.

If one p.p.m. be added to these waters, complaints of taste are liable to arise, and waste of bleach occurs.

The following modifications of Horrocks' method were investigated:—

(*a*) The bleaching powder was weighed, instead of being measured by volume; (*b*) further dilutions of the bleaching powder were made from the original mixture as made in the black cup of the Horrocks box.

The bleach was weighed on the ordinary dispenser's scales, using the Imperial equivalent of two grammes, which the scoop is reputed to hold. This was taken as thirty-one grains, as the dispensers' scales cannot weigh fractions of a grain.

The bleach was then mixed with ten ounces of water, instead of the amount held in the black cup filled to the white line, as is done in the original method.

It may be mentioned that the black cup, when filled to the brim, instead of to the white mark, holds, on an average, ten ounces.

The solution of bleach made in this ten ounces of water is discarded with the exception of two ounces. These two ounces are now diluted with water, distilled if available, to ten ounces.

It will be seen that the solution of bleach is now one-fifth of its original strength, and therefore contains one-fifth of the weight of a scoopful, i.e., 6·2 grains.

The remainder of the test is now carried out with the six white cups, to which the usual 1, 2, 3, 4, 5 and 6 drops of the diluted solution of bleach are added with a pipette as in the original method, as also the starch and iodide indicator.

The first white cup will now contain a dilution of 0·2 part per million of available chlorine, instead of 1 p.p.m. as in the original test, and the succeeding cups will now contain 0·4, 0·6, 0·8, 1·0, and 1·2 p.p.m. respectively.

These theoretical dilutions were checked, using a bleaching powder containing thirty-three per cent of available chlorine, and a comparison of the results of estimating the dilution actually present with those predicted was made.

The first white cup was found to contain 0·198 p.p.m., which is a negligible difference from the theoretical 0·2 p.p.m.

A further check was made with a bleaching powder containing twenty-nine per cent available chlorine and a comparison of the results arrived at by this modified method and by that of Sims Woodhead was made with an untreated canal water.

This water required 0·46 p.p.m. of chlorine to produce a blue colour with starch and iodide after standing half an hour as tested by the Sims Woodhead method.

The modified method test was preceded by an estimation of the chlorine in the first white cup.

This was found to be 0·164 p.p.m. as the chlorine content of the bleach used was lower than that used in the previous experiment.

It was then found that the blue colour of the starch and iodide was given in the third white cup, thus showing that 0·164 multiplied by 3, i.e., 0·492 p.p.m., were necessary to produce the blue coloration.

It will be seen that this modification is much more accurate than the original method, which varied in its results from 0·849 to 1·506 p.p.m., whereas the quantity shown by the Sims Woodhead method was 0·29.

In the modification the cup that should, theoretically, have contained 0·2 p.p.m. actually showed 0·198, a negligible difference, while in the second experiment the Sims Woodhead figure was 0·46 as against 0·492 of the modification—again a very small variation.

The modified method was then tried in the field. In the course of a water reconnaissance some fifty wells were tested, firstly with the original method, and secondly with the modification.

It was found that only four of the wells examined required the full 1 p.p.m., as shown by the original method, and that certain of the wells required as little as 0·2 p.p.m. to produce a lasting blue colour.

In conclusion, the suggested modification only differs from the original in the first two stages in two respects: (*a*) That thirty-one grains of bleaching powder are weighed out instead of taking the volume of a scoopful; (*b*) that instead of mixing the bleach with the amount of water contained in the black cup, it is mixed with ten ounces of water. Eight ounces of the mixture are then discarded, and the remaining two ounces are then diluted with water, preferably distilled, to ten ounces, and this dilute solution is then dropped into the white cups as in the original instructions; (*c*) the result is then that multiples of 6·2 grains of bleaching powder are required for each 110 gallons of water to be treated.

For a large supply the figures can be converted into pounds much more easily than the reputed contents of a scoop can be, as there is no necessity to convert two grammes to imperial measure as a first step.

For a small supply 31 grains can be mixed with 10 ounces of water and 2 ounces of this mixture will be required for 110 gallons when the blue colour is given in the first white cup, 4 ounces of the mixture if the colour does not appear till the second white cup, and so forth.

Or, if it is preferred, the appropriate multiple of 6·2 grains of bleach may be weighed out.

It is not suggested that this modification should be applied to Horrocks' test for use in the field; but it is submitted that it is a very useful method for use in cantonments where there is no laboratory, as it is more accurate,

can be performed by anyone, and will avoid the chronic over-dosing with chlorine that gives rise to so many complaints, and it would lead to a very considerable economy in the use and cost of bleaching powder.

The experiments were made in the Poona Water Works Laboratory, by the kind permission of Dr. Baretto, the Director.

I am greatly indebted to him and his assistants for their help and advice.

[The difference of more than one gramme in the weighings of a scoopful of bleaching powder is probably due to the state of the powder and not to any defect in the test.

Major Stanley Elliott has made many weighings at the Royal Army Medical College, and writes that "using the same spoon and the same powder, and measuring the powder in the correct manner, the weights should not vary more than 0·2 or 0·3 gramme. The volumes of the spoons as made for the Horrocks Box are very constant, and variations are due to the packing of the powder in the spoon."

Stabilized bleaching powder or "Tropical Bleaching Powder," which is now generally used with the test, is invariably a dry, finely ground powder, and Major Elliott considers that "measurement with the scoop, provided the piled material is not pressed into the scoop, and is cut off level, should be sufficiently accurate for all practical purposes."

The test does not indicate parts per million of chlorine unless the chloride of lime contains about thirty per cent of available chlorine. The important point is that the test indicates—without any weighings which are usually impracticable with units on active service—the amount of any specimen of chloride of lime which must be added to any particular water in the cart so as to obtain a slight excess of free chlorine lasting half an hour.

It is quite unnecessary to add an excess of chlorine when working with a comparatively pure water, one-quarter or one-half a scoopful of chloride of lime is usually sufficient, and the test can be easily carried out with these amounts.—ED.]

TWO CASES OF TROPICAL TYPHUS AND OTHER FEVERS.

BY MAJOR S. J. L. LINDEMAN, M.C.,
Royal Army Medical Corps.

IN view of Major Biggam's article on tropical typhus in the Journal of August, 1932, notes on the following cases of fever taken at the time in Karachi and Quetta are of interest.

From April 12 to 15, 1928, a party of five Gunner officers went on a pig-sticking expedition from Hyderabad Sind to the neighbourhood of the Munsher Lake.

They lived in a district bungalow and took all supplies from the Hyderabad Mess including drinks and tinned milk.

They stated that no local milk or butter was used and water was only employed for cooking or making tea.

By May 1, 1928, three of these officers had been admitted to hospital with severe continued fever. It would have been expected that they would all have the same disease, but actually each had a different affection.

Lieutenant A. arrived in hospital at Karachi on April 20 having had fever for three days. He complained only of headache; his temperature was 101-103° F., pulse 70; he was dull, and of lethargic appearance. He was covered from head to foot by a macular rash, most marked on the trunk, but also extending to the face, limbs, the palms of the hands, and soles of the feet. He remained quite ill for several days, his chief complaint being headache. The rash faded in three to four days, leaving a brown stain. The temperature came down by lysis, reaching normal on the fifteenth day. There was no recurrence and he returned to duty. All laboratory examinations for malaria, blood-culture, Widal reaction, urine and fæces examinations for enteric group were negative. Notes on the case were sent to Colonel Megaw, I.M.S., who was of opinion that it was a case of tick typhus, a number of cases of which had previously been reported in India, but not before from Sind. In this case no history of tick bite could be discovered, but pig-sticking ground would be eminently suitable for ticks. At the Hyderabad Mess were several dogs which at this time of the year were infected with ticks and frequently suffered from so-called canine tick fever.

Next came Lieutenant B., admitted on April 23, with four days continued fever; his temperature was 102-103° F.; he complained of headache and anorexia, and a slight irritating cough. He was constipated and his tongue was covered with a thick white fur, as though coated with white paint. The fur came off in patches leaving bright red areas. The fever lasted about a fortnight, then the temperature became normal for five days; a similar period of fever followed. Similar relapses with apyrexial periods of about five days continued till the middle of July. During the period of the fever the only complaint was loss of appetite, some headache, and occasional discomfort in the testicles. The tongue presented the same white painted appearance. A complete series of Widals and laboratory examinations failed to show any enteric group or other specific organisms in the blood, stools, or urine; no *Spironema recurrentis* was found and no agglutination with *B. melitensis* or *para melitensis*.

During July he was boarded for invaliding to the United Kingdom. He was sent back to Hyderabad in an apyrexial period to collect his kit; on return there he had no more relapses and remained perfectly fit and well, so his invaliding was cancelled.

Clinically this resembled a case of undulant fever, but bacteriological confirmation was never obtained.

The third officer, Lieutenant C., was admitted at the end of April, and ran a typical course of enteric fever, *Bacillus typhosus* being grown from his blood. He was seriously ill for some time, but made a normal convalescence.

Finally, while at Quetta in September, 1928, I was asked by Major E. B. Marsh, R.A.M.C., to see with him an officer who seemed very ill with what appeared to be malaria, but no parasites could be found. This officer had been sent in from a Brigade Camp, twenty miles out. It was noticed that his chest and abdomen were covered with a macular rash similar to that seen on Lieutenant A., though it was not so pronounced on the extremities, and some petechiæ were noticed. Severe headache was complained of. This patient was more seriously ill, but the fever ran exactly the same course, reaching normal by lysis on the fifteenth day. The Weil-Felix reaction was negative at first, but later became positive.

AN EXPERIMENT TO EXTERMINATE BUGS FROM INFESTED BUILDINGS.

By Major G. D. JAMESON,
Royal Army Medical Corps.

An ants' nest was placed in the ceiling of South Barracks guardroom, Gibraltar, in May, 1931.

A considerable degree of success was attained. Bugs decreased rapidly, and ants were observed attacking bugs and taking them to their nest. The subsequent disappearance of the ants can probably be attributed to the fact that the bug population was eventually so diminished as no longer to afford sufficient food supply to the ant colony.

A similar experiment was subsequently tried in a barrack room in South Barracks, the ants being placed in position in August, 1931. In this case the ants rapidly disappeared.

In both instances the species used was the small red ant (*Monomorium pharaonis*?), a small ant about $\frac{1}{16}$ of an inch long, which is common in Gibraltar.

The chief difficulties in carrying out this experiment successfully are: (*a*) In Gibraltar these ants usually build their nests in inaccessible places, e.g., under a tiled floor or under a patio paved with stone or cement, and emerge through a small hole and crack. It is, therefore, difficult to obtain a complete nest. (*b*) It is difficult to ensure that the ants will remain in the site selected for any length of time.

The following points appear to be absolutely essential for success: (*a*) An entire nest complete with eggs, etc., must be obtained. This probably explains the failure of the second experiment. Both the colonies of ants used were collected by myself, and while (1) was apparently a complete nest and contained a large number of eggs, (2) was more in the

nature of a collection of ants in earth and no eggs could be observed. (*b*) The ants' nest must be collected at the time of the year during which eggs are laid and hatched in large numbers. (*c*) Care must be taken that sources of food other than bugs are not available for the ants. Crumbs, etc., must be carefully removed after meals, and all stored food must be "ant-proof."

Water does not appear to be essential. In the experiments quoted above there was no known easily accessible water supply. Even if water is readily available, the worker ants do not appear to need it.

RUPTURE OF THE SPLEEN. SPLENECTOMY. RECOVERY.

By Major A. G. WELLS, D.S.O.,
Royal Army Medical Corps.

The following case being of such an unusual character seems worthy of recording :—

The patient, a big healthy Bombardier, aged 28, was admitted on the night of Friday, October 7, 1932, stating that at about 10 o'clock that evening he had been seized with acute pain in the abdomen, chiefly on the left side and running down into the left testicle. He had played hockey that afternoon, after which he had eaten a good supper. He was married, living in quarters.

He was seen by the Orderly Medical Officer who found nothing definite, either in his physical signs or symptoms; the temperature and pulse were normal, and he did not look ill. He had served abroad, but as far as he knew had had no illness.

On the following morning I was asked to see him. He still complained of pain down the left side running to the testicle.

There was no rigidity of the abdomen, and beyond appearing to be in some pain, the patient did not look ill. The lower part of the abdomen was slightly tympanitic, but no dullness could be elicited in the flanks. His tongue was dirty, but his bowels had acted the night before by means of an enema. He stated that his urine scalded when being passed. The only tender place in the abdomen was the right iliac fossa.

The leucocyte count was as follows : Total leucocytes, 22,400 per cubic millimetre; polymorphs, 81 per cent; lymphocytes, 17 per cent; mononuclears, 2 per cent. Examination of his urine revealed nothing abnormal.

I asked Major St. G. E. Harris to see the case with me and we decided that although unable to come to an exact diagnosis, it was certainly an abdominal crisis and that laparotomy was indicated.

Under stovaine, assisted by Major Harris, I opened the abdomen with a right paramedian incision. On opening the peritoneum large quantities of blood gushed out. The incision was rapidly enlarged and a hand intro-

duced. On palpating the spleen, the surface felt rough and unusual, although I could not detect a laceration. I decided to explore the spleen and made a transverse incision through the left rectus. On bringing up the spleen, it was seen to be almost completely decapsulated and bleeding.

Splenectomy was performed and the abdomen closed, a drain being left in down to the pelvis.

The patient was collapsed at the end of the operation and was given intravenous saline, camphor in oil, etc. On his return to the ward continuous subcutaneous saline was commenced and continued at intervals for the next twelve hours.

The next day I was able to get a more detailed history from him. It appears that he played hockey on Wednesday and was hit in the left side with a stick. It hurt him but he continued playing to the end and did not attach much importance to it. He carried on his duty during the next two days and played hockey again on the Friday, and it was some hours after that he was taken ill. His wife, however, says that during those two days he did have a fair amount of pain.

The patient has made a good recovery and the results of his blood examinations are interesting.

At the end of the first week the blood condition was as follows: R.B.Cs., 3,000,000 per cubic millimetre; hæmoglobin, 65 per cent; colour-index, 0·85; leucocytes, 17,000 per cubic millimetre; polymorphs, 72 per cent; lymphocytes, 20 per cent; mononuclears, 4 per cent; eosins, 4 per cent.

At the end of the second week: R.B.Cs., 4,000,000; hæmoglobin, 60 per cent; colour-index, 0·75; leucocytes, 15,000 per cubic millimetre; polymorphs, 70 per cent; lymphocytes, 21 per cent; mononuclears, 9 per cent. No abnormal cells were seen.

The report on the spleen was as follows: "Length, $6\frac{7}{10}$ in.; width, $3\frac{7}{10}$ in.; weight, 259 gr.; all above normal. Capsule stripped, old hæmorrhages under the capsule and on section, spleen shows hæmorrhages into the substance with clotting. Substance is firmer than normal and capsule not thickened. There is a small tear on anterior border. Section of spleen shows hæmorrhage, excess of eosinophile cells, no evidence of inflammatory change or interstitial overgrowth. Increased thickness of walls of arterioles."

Conclusion: It would seem probable that the blow received on the Wednesday caused a small tear on the anterior border and that a slow bleeding took place under the capsule. The game on Friday caused an increase of the hæmorrhage until at 10 p.m. the capsule gave way. The strange feature of the case is, however, the absence of symptoms or any localizing signs, and I imagine that had the patient been kept in bed after the injury on the Wednesday, the bleeding would have ceased and no further trouble have been caused.

My thanks are due to Major Harris for his assistance, and to Major Hood, A.D.P., Aldershot Command, for his report on the spleen and for the

various blood-examinations; also to the members of the Q.A.I.M.N.S. and Nursing Staff for their care of the patient after the operation, without which it is doubtful if he would have recovered.

I am also indebted to the Officer Commanding, Cambridge Hospital, for permission to forward this case for publication.

Echoes of the Past.

INSTRUCTIONS

TO

REGIMENTAL SURGEONS,[1]

FOR REGULATING THE

CONCERNS OF THE SICK,

AND OF

The Hospital.

WITH AN APPENDIX.

HORSE GUARDS,
September, 1803.

HIS Majesty having been pleased to approve the following Regulations for the Use of Regimental Hospitals, His Royal Highness the Commander in Chief hereby enjoins Commanding Officers of Regiments, of every Description, and all Regimental and Assistant Surgeons, to govern themselves, in their respective Duties, touching the Care of the sick Soldiers, and the Management of Regimental Hospitals, in strict Conformity thereto.

By Order of
His Royal Highness the
Commander in Chief,
HARRY CALVERT,
Adjutant-General.

[1] These Instructions are reprinted from a very rare copy, which was found by Major T. L. Fraser, O.B.E., R.A.M.C., on a barrow of second-hand books in Glasgow.

REGULATIONS,

&c. &c.

Introduction.

HIS Royal Highness the Commander in Chief having issued the most positive Orders to all Officers commanding Brigades and Regiments, to give very particular attention to the management of Regimental Hospitals, it becomes our duty to introduce such Rules and Regulations for the interior economy of the same, as may best provide for the health and comfort of the Soldier, and generally secure to His Majesty's Service all the advantages to be expected from our care and superintendance.

We hope the following Instructions, *duly attended to*, will be found conducive to those desirable and important objects.

The reports of the visiting Officer and of the Surgeon will afford such information to the Commanding Officer, as will satisfy him, with the help of his own occasional visits, that the several Duties of the Hospital are duly performed.

The journals to be kept by the Surgeon will be proofs of his diligence, and the best evidence of his professional ability.

Controul of the Hospital.

All Regimental Hospitals are under the immediate direction of their respective Surgeons, subject nevertheless to the general superintendance and controul of the Inspector General of Army Hospitals, and of any other Officers of the Medical Staff, who may be ordered by His Royal Highness the Commander in Chief, to inspect the same from time to time. They are to see that every part of the Hospital regulations has been observed;—to assist with their advice the attending Surgeon, and to propose to the Officers commanding Brigades or Regiments, such further improvements as they may deem necessary to the benefit of the sick, and of the service.

When a Regiment is divided and stationed in different quarters, the Medical Staff is to be equally distributed, that as few detachments as possible may be left to the care of country practitioners.

Each Regiment of 500 men and upwards, should be provided with a Surgeon and two assistant Surgeons.

Station of the Medical Staff.

The station of the Surgeon is always to be at the Head-quarters of his Regiment.—If the Regiment be divided into cantonments, the first assistant Surgeon is to be placed with the strongest detachment, and the second with the next in succession in point of numbers; and in no case, where the Regiment is thus divided and the Surgeon present, should either of the Assistants be allowed to remain at Head-quarters.

The Quarters of one of the Medical Officers of the Regiment should be always near the Hospital, and, when encamped, one of them is to sleep in Camp.

Leave of absence to the Medical Staff of Regiments must be regulated by the Commander in Chief's order of the 3d February 1803. (See Appendix, No. 1.) **Leave of Absence.**

When a Regiment is in Barracks, a Hospital is required to be provided and properly supplied with furniture, bedding and utensils, by the Barrack Department according to the regulation and the established schedule from that office, (App. No. 2.) In other situations the Surgeon will resort to his own Regimental stores, which he is on no account to encrease or replenish without previous permission; and, once a year at least, he will make a report of the state of them to the Inspector General. **Barrack Hospitals.**

When in Quarters the Surgeon must look out for a house suitable to the strength of the Regiment in a dry situation and with good water; but, before he engages it, he must state to the Inspector General of Army Hospitals, its rent and situation, with the number and size of the rooms—What wards have fire-places, and how many beds each room will contain.—Without this preliminary measure and the sanction of the Inspector General first obtained, no charge for a hired house will be allowed, unless very pressing emergency shall justify a departure from this regulation, and which must be stated in the first Weekly Return. **Hired Hospitals.**

No Hospital is to be engaged for a longer term than by the week; and to obviate every unnecessary encrease of Hospital Baggage, the Landlord should be required to provide the necessary equipments of fire-irons, tables and forms, or they must be hired elsewhere at a weekly charge.

The establishment of Hospital servants gives for a Regiment of 500 men and upwards, one Nurse at 1s. one Serjeant at 6d. and one Orderly at 4d. per day:—this is understood to be the maximum of Expence to be generally brought against the Public, under that head. In battalions of inferior numbers the expence of Hospital Attendants must be regulated in due proportion to their strength. If from unusual sickness further assistance be necessary, application must be made to the Inspector General for his approval of it, unless the pressure of the moment will not wait for such sanction; but the necessity must be then stated in the next Weekly Return. **Hospital Servants.**

This regulated allowance is intended for an entire Regiment; when the Regiment is separated, the Surgeon is

expected to exercise his discretion in dividing and apportioning the ordinary expence of the whole, in such a way as to meet the exigencies of all; thus, in the situation of a Regiment detached in three parts, it is advisable to discontinue the Nurse, and to employ three Orderlies in her stead; and, by so doing, to give a due proportion of assistance to each Detachment.

The Serjeant is to take charge of the bedding, utensils, and other Hospital Stores, and be himself answerable for any damage or loss.

Duties of the Serjeant.

This non-commissioned Officer should be selected by the Surgeon, with the approbation of the Commanding Officer, and be exempted from other military duties; nor should he be removed, except in cases of misconduct or inefficiency. He is to go round, at periods fixed by the Surgeon for administering Medicines and Nourishment, and to see that the Nurse and Orderly Man punctually give to the Patients what has been directed by the Surgeon:—he is likewise to observe that the Wards are kept clean, and that every Nuisance be removed as soon as possible. He is to see that every Patient has his face and hands washed, and his hair combed and tied, before the Surgeon visits the Hospital; and those men who are able to sit up are regularly to fold up their bedding, and to sweep under their beds every morning by six o'clock in summer, and eight in winter; they are likewise to separate their bedding, and to air it two hours every day in fine weather.

As quietness and rest are absolutely required in Hospital, great care is to be taken that every duty be performed with the least possible noise, and that at night the house be perfectly quiet. Every man must be in his bed by eight o'clock in winter, and nine in summer; and no conversation should be permitted after that time.

The Serjeant is to superintend the cleaning of the Wards early every morning, and as frequently during the day as circumstances may render it necessary. The pernicious custom of washing floors and covering them with sand, particularly during the winter, is positively forbid; and (as a far preferable mode of cleaning) dry rubbing should be substituted, by means of the scrubbing brush mounted on the heavy block. The Serjeant should go every morning and evening round the Wards, attended by the Orderly Man, to call a roli, and report to the attending Medical Officer, at the first visit, such men as were found absent; and whether the Hospital was regular, and in good order.

Orderly Man.

The duty of the Orderly Man is to assist the Nurse, by

attending the sick, administering the medicines and comforts, and keeping the Wards clean.

The Commanding Officer should be applied to for a guard, in order to furnish Sentries to the Regimental Hospital, and to the Hospital Tent; which Sentries are to be directed to admit no person but the Staff, the Officers of the Regiment and those immediately employed in the Hospital;—they are to be particularly careful in preventing liquor or any other articles from being carried into the Hospital, without the Surgeon's permission; nor are they to allow any Patient to go out (to the Necessary excepted) without a Ticket of Leave from the attending Surgeon. Sentries.

During encampment, a Hospital Tent is allowed in aid of an Hospital; but, except in cases of absolute necessity, it is not to be the sole Hospital; and great care should be taken to select a dry piece of ground for the Tent in the neighbourhood of the Regimental Hospital. A trench is to be dug round it for carrying off the water; and, to make it dry within, straw worked into thick mats or interwoven in slight hurdles, should be laid under every palliass, upon dry sand or gravel. Where such conveniences cannot be had, some fresh straw should be placed under each palliass, confined by a board twelve or fourteen inches high, placed round the sides of the bed; the straw to be changed at least once a fortnight. Hospital Tent.

Bedsteads seem to be too heavy an incumbrance for the ordinary equipment of a Regimental Hospital; but, in wet seasons or damp situations, during an Encampment, a few cot frames may be supplied from the general store in the neighbourhood, if the prevalence of any particular disease should call for them. Bedsteads

The windows of the Hospital Tent to be opened, and the walls to be lowered every day to admit fresh air; and, during that period, the beds of the Convalescents, and of others who are able to sit up during the day, are to be made, and the palliasses to be occasionally scoured with soap and water, under the special direction of the Surgeon. Rugs, blankets, &c. in fine weather, to be constantly hung out on bushes, or to be aired on the dry ground.

The Wards are to be frequently fumigated with nitric acid*, Fumigation.

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* Put half an ounce of Vitriolic Acid into a crucible, or into a glass, or china cup, or deep saucer; warm this over a lamp, or in heated sand, adding to it from time to time, some Nitre, or common Salt; these vessels should be placed at twenty or thirty feet distance from each other, according to the height of the ceiling, or virulence of the contagion. In Hospitals or Prisons, the Lamps or Vessels containing heated sand, may be placed on

and the plastered walls to be occasionally white-washed; but this last is not to be done in a hired Hospital, without the knowledge and approbation of the Commanding Officer:—And, in a Barrack Hospital, a due requisition for it must be made to the Barrack Master, who will have it executed. The sides of the Wards (when of wood) may be occasionally scoured with soap and water; but the floors should be generally kept clean by constant dry rubbing as before directed.

Every Patient on his admission into the Hospital, should (if possible) be previously inspected by one of the Medical Staff of the Regiment; and be made extremely clean with warm water and soap;—he should put on a clean shirt, and the clothes he had worn should be purified.

Venereal Patients.

All men with venereal disease, are to be confined to the Hospital.

Itch Patients.

Men with the itch should be cured in a separate Tent in summer, or in a separate room of the Hospital; such men should each bring a clean shirt for a change after they are cured:—four frictions or smearing the body all over four times, at six hours distance, with the sulphur ointment* (keeping in bed the whole time) will, in most instances, eradicate the complaint: They must then be well washed with warm water, and put on clean linen and clothes. Whenever this complaint prevails in a Regiment, there is to be a weekly inspection of all the men, by the Surgeon or assistant Surgeon.

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the floor, the fumigating Lamps of Moser may be employed for this purpose, although they would answer much better, if the saucer was deeper, and if, instead of a place for a Lamp, there was a Box proper for containing hot sand, in which the saucer might be placed; as fumigating with Nitrous Acid is attended with no inconvenience, and as the process is so simple, and the materials so cheap, it should, as a means of prevention, be employed for some hours every day, in Transports having Troops on Board, or in crowded Hospitals: and if there is any appearance of Contagion, the Fumigation should be executed with more care and attention, and the Vapour confined for several hours at a time. Fumigating Vessels or Lamps, should also be placed contiguous to the Hammocks or Beds of Persons affected with any contagious or putrid Distemper, whether Fever or Dysentry.

As the quantity of Vapour depends in some measure on the surface, it is better to have the Vitriolic Acid put in a number of small Vessels, than in one or two large ones, besides in this way, it has the advantage of being diffused more readily in any given space.

See Dr. Carmichael Smith, on Nitrous Vapour.

* R. Sulph. Viv. lbj.
Heleb. Alb. p. oz. iv.
Nit. dr. ii.
Sap. Moll. lbj.
Axung. Porc. lbiii.

Punished men should, if possible, be placed in a separate Ward, and their linen be frequently changed. Their bedding should be protected by a guard of oil-cloth under the sheet. Punished Men.

Every Patient to be provided with a clean shirt and a clean pair of stockings (if he can sit up) twice a week or oftener if necessary, and with clean palliass cases and clean sheets once a fortnight, or oftener, as particular circumstances may require.

The Patients should be shaved at least *twice* a week, and other personal cleanliness be observed as before directed.

All men with infectious diseases, putrid fevers, fluxes, small-pox, or measles, whose situation will admit of Removal, should be immediately sent from Camp or Barracks, to a separate house; or, in certain cases of exigency, to an Hospital Tent. Upon the death of a Patient, the whole of the bedding, after being steeped in running water, or in a tub, should be dried by the heat of an oven, and afterwards washed with soap and boiling water, before it is either used again, or put into the regimental Store: The like should be done with the bedding of the whole Ward. The straw about the bed of a man who dies, to be taken out and burnt, and the place or bed where he lay, to be well scoured with soap and hot water. Infectious Diseases.

In all cases of this sort, and particularly after the removal of a Corpse, the Ward is to be well fumigated.

No packs, &c. to be permitted to hang up, or lay in the Wards: The Non-commissioned Officer attending the Hospital is required, on the admission of a Patient, to take charge of his Necessaries, and is to be responsible for them. The Hospital is never to be crowded,—every man to have at least the space of five feet allotted to his bed, and each man a bed to himself. Charge of the Necessaries.

Men, when become convalescent, should not be reported too soon for duty. Convalescents.

The Surgeon is to be always in possession of a complete set of Instruments, provided at his own expence, agreeable to the List in the Appendix, No. 3. Instruments.

Regiments will be provided with Hospital Necessaries and Utensils, in proportion to their strength, on a due requisition to this Office. The Schedule (No. 4) gives a List of the established Articles; and, for the more ready conveyance, as well as better preservation of them, they have been formed into one or more Canteens, suitable to the strength of the Regiment, and the exigencies of Detachments. Hospital Utensils.

The regimental Surgeon, or assistant Surgeon, should regularly visit the Hospital, at least twice every day, and keep a Book of the Admissions, Discharges and the Cases of the Hospital Books.

Patients; in which the name, age, disease, diet, and treatment, are to be fully inserted, subject to the call of the Inspector General of Army Hospitals, or Commanding Officer of the Regiment.

Examination of Recruits.

The regimental Surgeon is to pay particular attention to the examination of Recruits, and be careful not to certify for any man's fitness to serve, into whose state of health he has not regularly enquired; and who has not, at his examination, been stripped of all his clothes to ascertain that he has no Rupture; that he has the perfect use of his eyes and ears, and the free motion of every joint and limb;—that he has no sore leg, or diseased enlargement of bones or joints;—that his appearance is generally healthy, and that he is neither consumptive, nor subject to fits;—with any of these Defects, the man is to be reported as unfit for Service.

Cow Pock Inoculation.

The inoculation of the Cow Pock is to be constantly practised. Let every man who does not bear the mark of the Small Pox, either by Inoculation, or otherwise, be subject to the trial of the Cow Pock (if it has not been already done) after the manner described in Appendix, (No. 5.) The Cow Pock occasions no disturbance to the frame, or confinement from Duty, and therefore may be performed either in Barracks or Quarters. When Cow Pock matter is wanted, application may be made for it to this Office; but the respective Surgeons are expected to use every Precaution to keep up a supply of fluid Matter.

By a general order of His Royal Highness the Commander in Chief (for which see Appendix, No. 6) the stoppage to be drawn from men in Hospital, is fixed at 10d. per Day.

Stoppage in Hospital.

In pursuance of the King's Warrant, dated 25th May, 1797,* the extra price of Meat and Bread is allowed to be charged by the Paymaster:—no more than 6d. per lb. for the former, and 1½d. for the latter, can therefore be included in the Surgeon's Weekly Returns; in cases where White Bread is necessary, the contract Bread must either not be drawn at all, or the difference alone must be inserted as an extra charge in the Stoppage Account, against the respective Man's name for whom it shall have been ordered.

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* From the 25th of May, 1797, the Soldier is to defray the whole Expence of his Bread and Meat; with this exception, that if Meat, of the quality proper to be provided for him, should exceed the price of six-pence a pound, or if Bread, of the household quality should exceed the price of three half-pence a pound; such excess of price shall be allowed to him upon a quantity not exceeding three quarters of a pound of Meat, and one pound of Bread a Day, for each Man.

The above Stoppage and the general Expenditure of the Hospital are under the immediate direction of the Surgeon, who will check and controul the Serjeant's accounts, being himself responsible for the due appropriation of the Money; as well as for the general Conduct of the Hospital, and of the Servants under his authority. Blank Forms of Returns will be regularly furnished by this Office, to be filled up and certified weekly, according to the Instructions given, and to be transmitted by Sunday's post, to the Inspector General. Weekly Return.

The Sick Return forming part of the Table, is to be filled up every fourth week, or that week in which the 20th of the month occurs: For example, if Wednesday be the 20th, let the next Sunday's Return give the account of Sick, but if the 20th fall on the Monday or Tuesday, it will be better to make it up on the preceding 18th or 19th, that it may reach this Office in due time for the general report to the Commander in Chief. This Return is to give the total number of the Sick of the Regiment whether at Head Quarters, in General Hospital, on Detachment, or on Furlough, and it is to be regularly sent on or about the 20th of the month, whether an Hospital be established or not. Sick Return.

For the sake of uniformity, the Diet in ordinary of the Sick is (in the Weekly Return) divided into four Classes, viz. full, half, low and spoon. Diet.

In the composition of these Diets, the Surgeon must conform to the Table in the Appendix (No. 7), except under Circumstances that can be satisfactorily explained in the next Weekly Return. Diet table.

The Diet Roll is to be daily filled up, and weekly signed by the Surgeon of the Regiment, and to be regularly filed for future Inspection. As this serves (with the Hospital Book) for a Voucher of the Charges in the Weekly Return, it behoves the Surgeon to be very circumspect in its detail; for if, on inspection, any Charges appear in the one that are not supported by the other, the Expence will inevitably fall on himself. Diet Roll.

When wine is indispensably necessary, it should be given as long as the urgency exists, but no longer; and porter or good beer should, whenever the case will admit of it, be substituted for wine. Administration of Wine and Porter.

(*To be continued.*)

Current Literature.

Commission on the Fumigation of Ships. Extract from the *Quarterly Bulletin of the Health Organisation of the League of Nations.* 1932, 1, 208.

The Health Committee of the League of Nations, in consultation with the Permanent Committee of the Office International d'Hygiène publique in 1928, set up a Commission on the Fumigation of Ships. This Commission collected information from the principal ports of the world, and special experimental work was organized in America by the Chairman, Surgeon-General H. S. Cumming. The Commission published a report and attached extracts from a preliminary report by a committee of experts who investigated the work carried out by the United States Public Health Service. The whole paper should be read by those concerned with the problem, but the following extracts may be of interest.

The Commission are not prepared to recommend any one particular method for the use of hydrocyanic acid until further experimental work has been done. Also they have not yet decided on a standard of quantity, but are of opinion that the minimum should be the use of 1½ ounces of HCN, or its equivalent, per 1,000 cubic feet (1·5 gramme per cubic metre) with an exposure of four hours, or of 2 ounces per 1,000 cubic feet with an exposure of two hours. This is for empty ships, but for loaded ships the time should be doubled. They consider that it is preferable to fumigate ships when empty as very great care and thoroughness are required if the ships are loaded.

It is considered that careful fumigation of a loaded ship will lead to destruction of eighty per cent. of the rats on board. If there is evidence of plague infection a loaded ship should be fumigated before unloading, and the process should be repeated if live rats are found later.

The United States Public Health Service has given great attention to the problem of the rat-proofing of vessels, from the point of view of the elimination of rat harbourages, and of protective work, i.e., shutting off from rats the principal harbourages; the great obstacle to such work is the cost.

The use of sulphur was also investigated, and the Commission are of opinion that sulphur dioxide is an efficient fumigant for rat extermination in empty ships; it is also useful in destroying fleas. Although they were unable to lay down definite standards they considered that a concentration of three per cent by volume with an exposure of six hours is sufficient. This concentration may be attained by burning three pounds of sulphur or by liberating five and a half pounds of liquid SO_2 per 1,000 cubic feet.

For destruction of rats in cargo vessels, and where time is not limited,

they consider sulphur fumigation useful, but in passenger vessels infected with vermin, hydrogen cyanide is preferable as it does not harm fittings and it kills vermin. The use of HCN necessitates a trained staff and removal of the crew, so usually the vessel must be tied up to a quay.

The Commission investigated the method employed in New York of estimating the concentration of HCN in ships undergoing fumigation. Gas is drawn through rubber tubes from various parts of the hold into a glass vessel on deck, and the time a strip of mercuric chloride methyl orange paper takes to change colour is noted and compared with estimations which have been made in the laboratory. They are not satisfied that this is a satisfactory procedure, and they consider that efforts should be made to find some more exact method.

It is advisable to mix a warning gas with HCN, but no satisfactory gas has yet been found. Cyanogen chloride has been given up, and chlorpicrin and chlorpicrin with brom-acetic ester are being used in America; also gas masks for protection and artificial respiration for resuscitation are being employed.

The action of HCN on food stuffs has been considered, a summary of all published work having been made by Dr. Monier-Williams in 1930. No evidence has been obtained of damage to foodstuffs by HCN as ordinarily used, but work should be done on the action of stronger concentrations of the gas, for it is known that fresh fruit may be damaged by high concentrations of, or by prolonged exposure to, the gas.

The Commission concluded that it is not desirable to restrict the use of any method of fumigation that gives satisfactory results, and that each sanitary authority should consider what methods are cheapest and most convenient under the conditions ruling in its ports. They also draw attention to the fact that ships are exposed to invasion by rats from the shore; that action taken under the International Sanitary Convention is steadily reducing the rat population in ships and that these populations will come more and more to depend on the number of rats in the ports visited.

Quarterly Bulletin of the Health Organisation of the League of Nations. Geneva, 1932, v. 1, 1—6. **Immunization against Diphtheria. Resolutions of the Conference held in London in June, 1931.**

The text of these resolutions, which received the approval of the Health Committee in October, 1931, is given below:—

"Resolution 1. Immunization against diphtheria, when carried out under suitable conditions and with efficient prophylactics, effects a large reduction in the diphtheria mortality and morbidity rates among children thus treated. This is proved by studies carried out under strictly comparable conditions, such as those observed during the recent enquiries.

"Resolution 2. The reactions sometimes observed after the injection of diphtheria prophylactics give no cause for alarm and should not interfere

with the campaign for the immunization of children, including tuberculous children, nor should they prevent the choice of the most active prophylactics.

"Resolution 3. The conclusion appears justified that, in spite of a few exceptional cases, the efficacy of immunization may be deduced from the change of the Schick reaction from positive to negative.

"Resolution 4. Taking as a basis the figures concerning the morbidity, the percentage of Schick reactions rendered negative after the injections of the immunizing agent, and a certain number of titrations of antitoxin in the blood of persons immunized, it may be concluded that formol toxoid (anatoxin) is the most efficient of those antigens which have been the subject of our comparative study, i.e., mixtures of toxin, antitoxin and formol toxoid (anatoxin), and should be recommended for the present.

"Resolution 5. The clinical observations submitted to the Conference indicate that, so far as can be determined up to the present, the immunizing power of formol toxoid (anatoxin) in man appears to be in relation with the antigenic value of the prophylactic as measured by the flocculation method.

"Resolution 6. The method of administration recommended is by subcutaneous injection. When this is not possible, the prophylactic may be applied to the nasal mucous membrane. Our experience with the cutaneous method has not been favourable.

"Resolution 7. Immunization should be carried out by means of three injections. It is hoped that, in the future, the use of a more active prophylactic will make it possible to immunize with two or perhaps even one injection.

"Resolution 8. The intervals recommended between injections are three weeks between the first and second injections, and at least two weeks between the second and third.

"Resolution 9. It is unnecessary to carry out the Schick reaction before immunization. It is, however, desirable to use the Schick reaction before and after immunization in a certain proportion of subjects in order to determine the value of the method employed.

"Resolution 10. It is recommended that immunization against diphtheria should be carried out not later than during the pre-school period, after the end of the first year of life.

"If the children have not been immunized during the pre-school period, they should be immunized, if possible, during the first year of school attendance.

"Resolution 11. Charitable organizations and administrations receiving children in homes (holiday camps, 'Preventoria,'[1] sanatoria, etc.) are advised to require, from both children and staff, a diphtheria immunization certificate on admission or a certificate attesting that the Schick reaction was negative.

[1] Institutions for delicate children.

"Resolution 12. Immunization is recommended for medical, nursing and domestic staff in hospitals, homes, dispensaries, sanatoria, schools, etc.

"Resolution 13. Immunization is to be recommended even during epidemics in the case of children who have been in contact with patients, as there is so far no evidence on record as to the existence of a negative phase.

"Resolution 14. In the opinion of the experts, diphtheria immunization should form the subject of active public education on the part of the health administrations of the different countries in order to bring home to everyone the advantages of this method of protection in safeguarding the public health."

Reprinted from "Bulletin of Hygiene," Vol. 7, *No.* 10.

LORENTZ, F. H. Neues zur Züchtung der Diphtheriebakterien. [**A New Medium for the Diphtheria Bacillus.**] *Zent. f. Bakt.* I. Abt. Orig. 1932, v. 124, 516-18.

A new medium for the growth and isolation of the diphtheria bacillus is described which is claimed to be easy to prepare and sterilize and favours the typical morphology of the bacillus :—

Forty grams of Soya-bean meal is digested with 2 grams of dry pepsin and 10 cubic centimetres of HCl in 990 cubic centimetres of distilled water. After digestion the solution is sterilized and brought to about pH 8·0. Plates are made by taking 14·4 cubic centimetres of this solution and mixing it with 0·3 cubic centimetre of a 0·1 per cent cystin solution, 1 cubic centimetre of a 10 per cent di-sodium phosphate solution and 14·4 cubic centimetres of a 4 per cent solution of filtered and sterile agar.

C. C. OKELL.

Reprinted from "Bulletin of Hygiene," Vol. 7, *No.* 10.

RAMON, G., TIMBAL, G. & NÉLIS, P. Valeur antigène déterminée par la floculation et pouvoir immunisant de l'anatoxine diphtérique chez l'homme. [**Determination of the Antigenic Value of Formol-Toxoid (Anatoxin) in Man.**] *C. R. Soc. Biol.* 1932, v. 109, 1257-9.

Observations are recorded indicating that the flocculation values (Lf) of toxoid run parallel with their antigenic efficiency in man. The observations were carried out among Belgian children, all the children being given two doses of toxoid (1 and 1·5 cubic centimetres) at 21 days' interval. The Schick tests were carried out 15 days after the last injection of toxoid. 341 Schick positive children were immunized with a toxoid of 16 Lf. value with a resulting Schick-negative rate of 96 per cent, 162 showed a Schick-negative rate of 81 per cent after treatment with 7 Lf. material, and 19 children a negative rate of 10 per cent after treatment with 2 Lf. material.

C. C. OKELL.

Reprinted from "Bulletin of Hygiene," Vol. 7, *No.* 10.

Reviews.

Minor Surgery. By Lionel R. Fifield, F.R.C.S. Second Edition. Revised by R. J. McNeill Love, M.S., F.R.C.S. London: H. K. Lewis and Co., Ltd. 1931. Pp. vii + 400. Price 12s. 6d.

The untimely and tragic death of Mr. Fifield cut short an obviously brilliant career. The first edition of this book in 1925 had already established a place for itself in surgical literature; it represented minor surgery as practised at the London Hospital. Mr. Love has now revised and brought up to date the first edition. Some additions have been made and a short section on the ear has been included. The general style and arrangement have been altered as little possible.

This now well-known book on minor surgery thoroughly merits its place in surgical literature. It can be recommended as a sound and practical guide to the senior student and House Surgeon. J. M. W.

The Extra Pharmacopœia. Vol. I. Twentieth Edition. By W. H. Martindale, Ph.D. London: H. K. Lewis and Co., Ltd. 1932. F'cap 8vo. Pp. xliii +1216. Price 27s. 6d. net.

This book needs no introduction from us. The type has been entirely reset and although it contains much more information than the previous edition, the actual bulk of the book appears to be somewhat diminished. It was only natural to anticipate that many alterations and amendments would be necessary owing to the arrival of the British Pharmacopœia of 1932, and those responsible for the revision of the Extra Pharmacopœia are to be congratulated on the way in which the new matter has been arranged and incorporated. Fresh and up to date information will be found under antimonial and arsenical derivatives, the chaulmoogra preparations, halogenized salicylic acid compounds, sclerosing agents for varicose veins and the new quinine compounds for the treatment of malaria. In addition very full information will be found concerning ephedrene, choline salts, organotherapy and vitamins. The sections relating to Patents, Trade Mark Law, and the Dangerous Drugs Acts have been revised and will be found very useful not only by manufacturers but by members of the profession as well. The book also contains a therapeutic index of diseases in which an enumeration of medicaments and other helpful facts are given; in the concluding pages a very complete combined index and posological table will be found. The book should be in every hospital dispensary as a work of reference for both medical men in residence and dispensers. To a dispensing chemist, the book is invaluable and is a sound investment. R. P.

THE PRINCIPLES AND PRACTICES OF RECTAL SURGERY. By William B. Gabriel, M.S.Lond., F.R.C.S.England. London: H. K. Lewis and Co., Ltd. Pp. viii + 248. Illustrations 118, including 8 coloured plates. Price 20s. net.

How very seldom can the reviewer of a surgical work honestly state that he has read the book from cover to cover. The fact that this has been done in this instance goes to show that this little book is of more than ordinary interest.

It sets out in detail the modern practice of Rectal Surgery as practised at St. Mark's Hospital and can be read with profit by students, general practitioners and surgeons.

For students the careful directions of how to examine a rectal case, if fully assimilated, will prevent many of the errors or delay in diagnosis which are so often disastrous to the patient.

The general practitioner will find all that is necessary to guide him as to what cases of hæmorrhoids are suitable for treatment by injection, and the details of the method are so clearly given that he should have no difficulty in carrying out the treatment with a modest surgical equipment.

The chapter on pruritus ani is well worth study, and it is interesting to note that the work of MacArthur on the rôle played by threadworms is incorporated. A knowledge of this in the past would have obviated many unnecessary and unsatisfactory operations.

The methods of dealing with inveterate cases of pruritis ani by injections are fully discussed. In the author's hands injection with A.B.A. has given good results, but no extravagant claims are made and the value of the method is fairly presented.

Proctologists will peruse with special interest the chapter devoted to cancer of the rectum. The views on the spread of rectal carcinoma as conceived by the St. Mark's School are clearly and convincingly set forth, and their correctness would appear to be borne out by the operative measures based on this conception.

As the author states, "the period of radium hopefulness is waning fast as far as the rectum is concerned"; cure can be obtained in many cases, but only by operation. The preparation of a patient for operation, the operative technique, and the after-care of the patient are clearly and carefully given. The type of operation favoured by the author is colostomy followed by perineal excision of the rectum in all cases to which it can be applied. The statistical tables show that with increasing experience of this method the operability rate has risen from 41·6 per cent during the period 1910 to 1920, to 54 per cent during the period 1921 to 1931. At the same time the operative mortality shows a fall from 16 for 100 cases in 1910 to 1920, to 4 for 70 cases in 1930 to 1931.

An interesting table is given showing the three-year survival rate according to the depth of the spread of the growth and strongly emphasizing

the value of this method of classification. Early cases show the remarkable figure of 83 per cent of three-year cures.

A short and favourable reference is made to the method of perineo-abdominal excision as elaborated by Professor Grey Turner, and its advantages over the one-stage abdomino-perineal excision of Miles are set forth. We would have been glad, however, to see further reference to the method of Mr. Miles, which in his expert hands is able to show such good results.

The author expresses his doubts about the advisability of conservative resection of the rectum for cancer.

The final section on radium treatment of cancer of the rectum tells how after a long and careful trial of the method at St. Mark's the author has been driven to the conclusion that except for squamous carcinoma of the anal canal or anus, radium is of no value in treatment of the conditions and in inoperable cases often adds to the misery of the patient.

The book is a pleasure to read. It is completely free from padding and is so clearly expressed that it is never necessary to re-read a section to ascertain the author's meaning.

It is well printed and excellently illustrated both in colour and by line drawings which are commendably clear.

For those who wish to explore the subject more fully a complete bibliography is given at the end of each chapter.

This little book can be confidently recommended as an interesting and authoritative account of the present position of rectal surgery.

J. W. W.

The Injection Treatment of Varicose Veins, Hæmorrhoids, and other Conditions. By R. H. Maingot. London: H. K. Lewis and Co., Ltd. Pages xii + 100. Crown 8vo. Price 4s.

This excellent little book, which can be easily read at an after-dinner sitting, should be of great assistance to those who are contemplating the treatment of the various conditions which are amenable to sclerosing injections.

As the author states, this is the first time that all the diseases for which injection treatment can be employed have been collected together into one small volume. While he is dogmatic in his teaching, no extravagant claims are made for the methods, and the types of cases for which they should not be employed are carefully detailed. The importance of a complete examination of the patient before undertaking treatment is rightly stressed.

The reader will find full details of the various solutions employed and valuable hints as to their respective values. The author's wide experience of the method will give confidence to anyone taking up this treatment for the first time.

The chapter on the treatment of varicose ulcer by the Dickson Wright method contains many valuable hints which will be of assistance to anyone

carrying out this popular method of dealing with what was formerly an intractable condition.

The last chapter groups together all the various conditions for which injection treatment may at times be used. These include hydrocele, variocele, bursa, hernia, &c.

The question of the cure of hernia by these methods is treated with a wise restraint, but it is clear the author considers that in selected cases the treatment may be of value.

This little book is excellently printed and free from typographical errors. There is a good index and each chapter has a complete bibliography.

It can be recommended as a useful addition to the library of all doctors.

J. W. W.

Correspondence.

THE NATURE OF VIRUS AGENTS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—May I be allowed to supplement my recent paper on the above subject (this Journal, vol. xlix, pp. 263, 343) with certain further considerations which are of importance? In a recent number of the *Lancet* (December 10, 1932, p. 1285) it was pointed out that the size of the particles constituting various strains of bacteriophage have been fairly closely determined by means of the collodion-membrane filter. They have been found to vary from a minimum of 8-12 millimicrons ($\mu\mu$) up to a maximum of 50-70$\mu\mu$; that is to say, from 0·008-0·012μ up to 0·05-0·07μ. The virus-particles of foot-and-mouth disease also are stated to fall within the same range of size. Now the molecule of hæmoglobin is estimated to be about 30$\mu\mu$, or 0.03μ, roughly mid-way between the two extremes given. This substance, however, complex though it is, is probably by no means so elaborate in molecular constitution as the nucleins and nucleo-proteins, whose composition has yet to be ascertained. And, certainly, neither hæmoglobin nor even the nucleo-proteins can be said to be living matter, with the properties and functions of life. Is it in the least degree likely, therefore, that the bacteriophage and the virus of foot-and-mouth are animate—in other words, organisms? Further, foot-and-mouth is a typical animal virus disease. The respective causes of other virus-diseases are, almost certainly, a similar type of thing to the agent causing foot-and-mouth. What applies to one, applies logically to all.

Another point to which reference may be made is that there has been a tendency latterly on the part of some (e.g., J. S. Haldane), in order to overcome the difficulty arising from the invariable, obligatory association of these virus-agents with cells, to consider the cell (or cytode, as the bacterial body may be termed) as not being the indivisible unit

of life, but as consisting of, or at any rate containing within itself, minute units, which are themselves alive. In other words, a cell is regarded as being, really, a colony of lesser units. This is, in my opinion, a very far-fetched and unlikely assumption. As I have said elsewhere (*Lancet*, 1930, i, p. 211), "in any particular living thing, whether one of the lowliest cell-units, such as a bacterium, or a highly differentiated one, a congeries of which make up the body of a multicellular animal, we have not *the slightest evidence* that, in such a unit, there are contained lesser or simpler elements which subscribe to the definition of life." If the minute elements under discussion were indeed animate, we should almost certainly find them, or forms corresponding to or representing these "micro-micro-organisms"—and probably in abundance—*free in nature*; just as we find animals consisting each of a single cell, homologues of the colony of which the metazoan body is built up. Yet no one has ever observed anything like them! Neither can any fermentative action, or metabolic changes of any kind, indicating nutrition of animate matter, be noted in any cultures or preparations, *which have been freed* from living organisms conforming to the accepted definition. This particular objection has been already raised, indeed, by Boycott (*vide* second reference given above). Is not this fairly conclusive evidence against such a view?

As has been clearly shown, therefore, every consideration, whether biological or microscopical, which has been discussed, points unmistakably to the actual causative agent of these various viruses being, *not* a living organism, but rather some enzyme or ferment produced pathologically by cells. In the case of the smallest-known particles with which the power of acting as a virus is associated, such as those of the bacteriophage, foot-and-mouth, transmissible fowl-sarcoma, it is not unlikely that these represent, respectively, the actual molecules of the particular enzyme concerned in *nearly* a pure state, i.e., adsorbed on to an extremely minute quantity only of extraneous colloid material (substrate). Starling has said, in his "Principles of Human Physiology," that "it has hitherto proved impossible to obtain any preparation of any enzyme which can be regarded as a pure substance," because of the tendency of enzymes, which are themselves colloidal or semi-colloidal in nature, to adhere to colloidal matter. These remarks apply, of course, to the digestive enzymes contained in the various digestive juices, which indeed come almost in the category of solutions! And the above-named viruses are to be regarded as approaching near to this end of the scale. On the other hand, in many viruses, such as those of vaccinia, herpes, the "Rickettsia"-diseases, etc., the enzyme cannot be separated from comparatively conspicuous particles of colloid matter, of relatively appreciable size. In many cases, this colloid material seems to have a minimal size-limit of 0·2-0·25μ (in the stained condition). The various examples given by Coles and Merlin, in the paper I cited, are illustrative in this connection.

This difference is probably of considerable physiological importance in

regard to the behaviour of the virus in different cases. Because, in the former type, it may be expected that the ferment will be diffusible and capable of being passed out of the affected cell, i.e., secreted extracellularly. Whereas, in other cases, where the ferment only occurs adsorbed to the larger, readily manifest particles of colloid matter, its properties as a virus, in regard to diffusion, sedimentation, etc., will be or may be markedly different. A few examples will make this clear. Where the action of the ferment is entirely intracellular, as probably in the case of ordinary, non-glandular epithelium, the virus will not be liberated until the cell dies and disintegrates and the particles of the altered, or abnormally digested, material are scattered. Even where the abnormal ferment is secreted extracellularly, as, for instance, in the case of the intestinal epithelium of the louse, it may be at once adsorbed on to the liquefied hæmoglobin and hence not separable from the "Rickettsia"-bodies. In special cases, where particular types of cell are concerned, both conditions may be found. Such a combination most probably occurs in the case of hydrophobia, where, on the one hand, the virus will be adsorbed on to the Negri-bodies and the particles into which these become fragmented occurring in certain nerve-cells, and on the other hand will also be present, in the nearly pure state, in the diffused secretion of the salivary glands. (As I indicated in my paper, I have reason to think that, now and again, the abnormal enzyme may also be passed out of certain nerve-cells.) If these considerations are borne in mind they may help to explain some of the contradictory results reported in experimental and Pasteurization-work upon this virus.

Crosswyn,
Walton-on-Thames.

I am, etc.,
H. M. WOODCOCK.

Notice.

THE ROYAL SANITARY INSTITUTE.

A COURSE of practical training for intending candidates for the Examination for Inspectors of Meat and Other Foods will commence at the Institute on Friday, February 10, 1933. Full particulars can be obtained from the Secretary of the Institute, 90, Buckingham Palace Road, London, S.W. 1.

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Journal

of the

Royal Army Medical Corps.

Original Communications.

CADETS, PAST AND PRESENT.

A RECORD OF PHYSIQUE.

BY MAJOR M. J. WILLIAMSON, M.C.,
Royal Army Medical Corps.

THERE is, I suppose, little doubt that as a race we are bigger men than were our forefathers of the age of chivalry and for a century or two later. I was looking at some body armour of the Elizabethan period in the Royal Military Academy gymnasium the other day, and the only conclusion I could come to was that the man-at-arms who fought the Spaniard must have been a small man from a modern standpoint. The chest pieces would not fit an ordinary Gentleman Cadet of to-day.

Records exist in the R.M.A. which give various physical measurements of all the cadets who have passed through since 1865. I suppose other institutions have similar records and, no doubt, comparisons of physique between this century and the last have been made and the data published. Not having seen any such comparison made in our Journal, it struck me that an analysis of the eminently satisfactory result might stimulate our pride of race, and confound those gloomy people who persist in telling a rapidly emptying clubroom that the country is going to the dogs, and that the young man of to-day is a weed compared to the stout young fellows of the good old days.

Like many such generalizations, the latter statement is made without any data to support it more reliable than the speaker's own convictions. These same convictions are probably based on a recent unsatisfactory interview with a scallywag nephew, gifted with a too-free tongue, or a body

which is generally seen lolling in the most comfortable chairs of the drawing-room.

The cadets of the R.M.A. are, perhaps, a selected class in that they have to reach a prescribed medical standard and sit for an examination which demands a moderate amount of brain power to pass successfully. I think, however, they may be taken as a very average sample of the product of the public schools of Great Britain of their time.

Weights and heights together give a very fair idea of the physique of an unknown specimen of fit humanity. After three years at the R.M.A. my experience is that if the heights and weights are in normal proportion, the other measurements, i.e., chest and limbs, are normally what one would expect to find. It is true that some of the term averages do show a slightly better average chest measurement in comparison with others of similar weight, but if the averages are collected from a number of terms and compared with the results of the averages of another similar number, it is found that weight and size of chest have a definite proportionate inter-relationship. This is well shown in Table I of the Appendix where a comparison is made between the pre-war and post-war weights and chest measurements. These figures are given to show the definite improvement of post-war physique over pre-war physique as well as to demonstrate the point made above.

The figures of Table II of the Appendix demonstrate the differences between the heights and weights of this century and the last. These records were made at the cadet's entry and the Spring Term of each year has been selected for comparison. Taking the figures of last century and comparing them with those of the present one, at first glance the difference in favour of the latter in both heights and weights is striking. If, however, one looks at the ages, one notes that cadets entered the R.M.A. almost a year younger in the last century than they do now. They then did two years instead of the modern eighteen months. During the two years I found that they put on from 4½ to 5½ lb. in weight on an average. This weight, added to the average weights at joining of last century's cadets, still leaves them considerably in arrear of the average weights of present-day cadets at any stage of their careers.

In an endeavour to eliminate any age fallacy sixty cadets (the approximate size of a modern term) were taken from the roll of 1870 and onwards as they came, irrespective of terms. Their heights and weights when they left were taken from the figures given in the records, and averaged. By that time their average age was just under 20. The result of these calculations showed that their average height and weight was 5 ft. $8\frac{1}{10}$ in. and 10 st. 2½ lb. respectively. Compare this with the average height and weight of the August, 1932, entry, viz., 5 ft .10 in. and 10st. 8 lb., and remember that the average age is only 18½.

I do not think there is any doubt that the physical standard of the class of lad we are dealing with is definitely on the upgrade. There is little

difference between the standard shown in the two periods of last century although they are separated by twenty years. The 1910-12 period shows a marked advance, even if the difference in ages is taken into account. The 1920-22 period demonstrates the vitiating effect of the war, and weights have fallen. From 1930 to the present day figures the rise begun earlier in the century continues.

What is the cause of this improvement in our physicial characteristics? It might be ascribed to all sorts of causes, e.g., better living conditions, modern sanitation, more enlightened medical attention, or child welfare. Better feeding, to my mind, is the answer to the question. The feeding at the public schools has undoubtedly improved. The additional supply of vitamins and the more or less correct amount of calories in the public school diets of to-day must be the predominant causal factor for the better-built bodies.

A dear old gentleman of 70 came down to stay with us the other day. I showed him some comparative tables of weights and measures with the remark that the better feeding at modern public schools was the cause of our present-day physical superiority. He brought his fist down with a bang. "My boy," he said, "you are backing the right horse there! Why, when I was at school at C.——— I was always hungry! I spent every penny of my pocket money—and that wasn't much—in buying as much food as I could." Note "food," not cakes or sweets. He felt he had to have more solid sustenance, and quantity was what he went for. Boy is a hungry creature, and some of the lads of to-day tell me they often used to feel hungry at school, but their statements have not got the vigour and conviction of the old gentleman's, whose hunger had obviously been one of the outstanding facts of his adolescent life. On the other hand, quite a number of cadets admit that they were quite well fed at school.

A strong piece of confirmatory evidence of the truth of the food theory is that the weights of the 1920-22 sequence (Table II) are below those of the sequences of ten years before and ten years after it. That post-war drop in weight must be due, I think, to war-time feeding. I do not believe most of us realize how bad the public school feeding was in the latter years of the war. The other day I was talking to a young officer who was at a famous public school during that time. He told me they had meat twice a week only, the staple breakfast food was maize porridge (an unpleasant dish) and that tea consisted of a square of bread cut in four with cocoa butter to go with it. When they could afford it, they used to buy Quaker Oats and make porridge at night, because it was the most filling thing they could get.

If the hypothesis that the public school feeding of to-day has improved be accepted, and I think it must be, it will be realized that it is one of the few factors in public school life which has altered enough to be considered as the probable cause of the present-day higher standard of physique. In many ways the boys are more comfortable than they used to be, but I

doubt if the physical development side has altered a great deal. They play the same games and do much the same sort of things as they have always done.

I must admit that I do not know much about the details of modern public school life or, for that matter, about the workings of those of last century, but I cannot help feeling that our better knowledge of dietetics must be the central figure in the sum of public school improvements, and it is to that knowledge the sturdier physique of the lad of to-day is due.

Appendix.

Table I.

Comparison of Weights and Chest Measurements.

Pre-war v. Post-war.

	Weight	Chest minimum	Chest maximum
Averages of all cadets joining and leaving, 1910-14 :—			
Joining	10 st. $1\frac{3}{4}$ lb.	$32\frac{6}{10}$ in.	$35\frac{3}{4}$ in.
Leaving	10 st. $8\frac{3}{4}$ lb.	$33\frac{1}{10}$ in.	$36\frac{7}{8}$ in.
Averages of all cadets joining and leaving, 1928-32 :— (*Four terms leaving and six terms joining.*)			
Joining	10 st. $6\frac{1}{2}$ lb.	$32\frac{7}{8}$ in.	$36\frac{1}{2}$ in.
Leaving	10 st. $13\frac{3}{4}$ lb.	$35\frac{5}{8}$ in.	$37\frac{1}{2}$ in.
Balance in favour of the Post-war period :—			
Joining	$4\frac{3}{4}$ lb.	$\frac{11}{40}$ in.	$\frac{3}{4}$ in.
Leaving	5 lb.	$\frac{21}{40}$ in.	$\frac{5}{8}$ in.

Table II.

Four Terms Some Sixty Years Ago.

	Date	No. in term	Height	Weight	Age	Remarks
Spring	1869	50	5 ft. $7\frac{7}{10}$ in.	9 st. 6 lb.	$17\frac{8}{12}$	Only one boy 6 ft. or over and he was alone in being over 12 st.
,,	1870	36	5 ft. $8\frac{5}{10}$ in.	9 st. 6 lb.	$17\frac{1}{2}$	Two over 6 ft. None over 12 st.
,,	1871	40	5 ft. $7\frac{9}{10}$ in.	9 st. $9\frac{7}{20}$ lb.	$17\frac{9}{12}$	Two 6 ft. or over. None over 12 st.
,,	1872	47	5 ft. $8\frac{3}{10}$ in.	9 st. 11 lb.	$17\frac{8}{12}$	Three 6 ft. or over. Three 12 st. or over

Note.—Ages during this period ranged between 16 and 19 years.

Three Terms Forty Years Ago.

	Date	No. in term	Height	Weight	Age	Remarks
Spring	1890	30	5 ft. $8\frac{3}{10}$ in.	9 st. $4\frac{3}{4}$ lb.	$17\frac{2}{12}$	One boy over 6 ft. He was 11st. 1lb. and the heaviest.
,,	1891	59	5 ft. $7\frac{7}{10}$ in.	9 st. $7\frac{1}{2}$ lb.	$17\frac{3}{12}$	Three 6 ft. or over. Greatest weight, 11 st. 13 lb.
,,	1892	50	5 ft. 8 in.	9 st. $9\frac{1}{2}$ lb.	No ages given	Three 6 ft. or over. Greatest weight, 11 st. 9 lb.

Three Terms Twenty Years Ago.

	Date	No. in term	Height	Weight	Age	Remarks
Spring	1910	80	5 ft. 9 $\frac{6}{10}$ in.	10 st. 5 lb.	No ages given	Eight were 6 ft. or over. Only one over 12 st.
,,	1911	72	5 ft. $9\frac{6}{10}$ in.	10 st. 3 lb.	Slightly over 19	Twelve were 6 ft. or over. Only one over 12 st.
,,	1912	127	5 ft. $9\frac{2}{10}$ in.	10 st. 6 lb.	$18\frac{1}{2}$ (approx.)	Fourteen were 6 ft. or over. Greatest weight, 11st. 12 lb.

Note.—Ages in this series are carelessly marked up in the register. Age last birthday given in most cases; months shown against a minority only.

TABLE II (*continued*).

	Date	No. in term	Height	Weight	Age	Remarks
			Three Terms Ten Years Ago.			
Spring	1920	68	5 ft. 9 in.	10 st. $2\frac{1}{2}$ lb.	$18\frac{3}{12}$	Six of 6 ft. or over. Three over 12 st. Heaviest, 12 st. 3 lb.
,,	1921	69	5 ft. $9\frac{1}{2}$ in.	10 st. 3 lb.	$18\frac{3}{12}$	Ten of 6 ft. or over. None over 11 st. 10 lb.
,,	1922	63	5 ft. $9\frac{3}{8}$ in.	10 st. 2 lb.	$18\frac{1}{12}$	Eight of 6 ft. or over. Two over 12 st.
			Four Terms Present Day.			
Spring	1930	57	5 ft. $9\frac{1}{2}$ in.	10 st. 5 lb.	$18\frac{1}{2}$	Eight of 6 ft. or over. Four over 12 st.; included one 13 st. 3 lb. and one 13 st. 10 lb.
,,	1931	56	5 ft. 9 in.	10 st. $7\frac{1}{2}$ lb.	$18\frac{1}{2}$	Three of 6 ft. or over. Six of 12 st. or over
,,	1932	59	5 ft. 10 in.	10 st. 6 lb.	$18\frac{1}{2}$	Fourteen of 6 ft. or over. Five of 12 st. or over
Autumn	1932	55	5 ft. 10 in.	10 st. 8 lb.	$18\frac{1}{2}$	Sixteen of 6 ft. or over. Five of 12 st. or over

NOTE.—Non-British cadets were on the roll of the R.M.A. in appreciable numbers during the 1930-32 period. They have been omitted from these averages.

A DESCRIPTION AND NOTES ON USES OF A MOBILE DRESSING STATION.

By Colonel W. LISTER, T.D.,

and

Major H. A. SANDIFORD, M.C.,

Royal Army Medical Corps.

"The medical service in the field is organized to ensure rapid evacuation of sick and wounded, including prisoners of war. The efficiency with which this system is organized and administered greatly affects the mobility and morale of the Army." (Field Service Regulations, Vol. I, 1930, Section 112.)

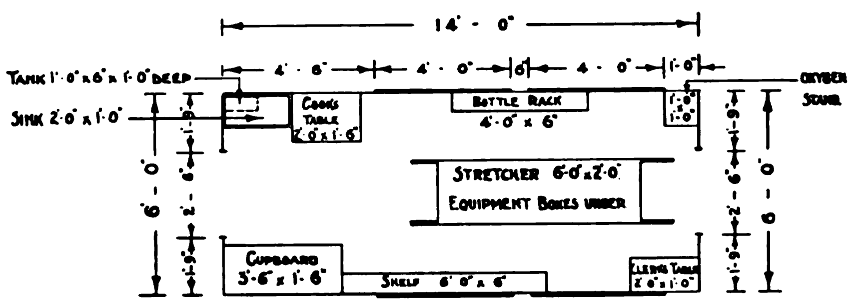
With the idea of assisting in the evacuation of sick and wounded a Mobile Dressing Station has been designed. The following short description will enable the main points to be understood.

Description of a Mobile Dressing Station.

The dimensions of the body are as follows: Length, 14 feet. Height (inside): 6 feet 6 inches (not as shown on plan). Width (inside): 6 feet.

There are two entrances, at the front and rear, in a central position, 2 feet 6 inches wide; the doors open outwards, and are fitted with gas curtains.

The dressing station is lighted by circular port holes at the front and rear, 9 inches in diameter. There are also two lights in each side, each



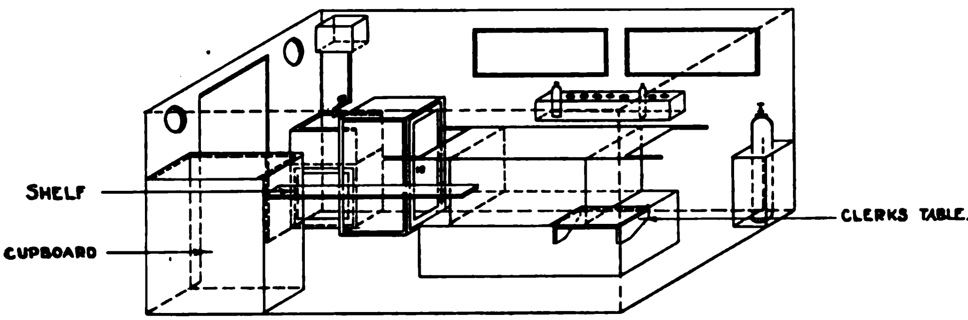
PLAN

light 4 feet by 1½ feet. In the roof there is a light 2 feet by 1½ feet placed directly over the stretcher (*vide* plan).

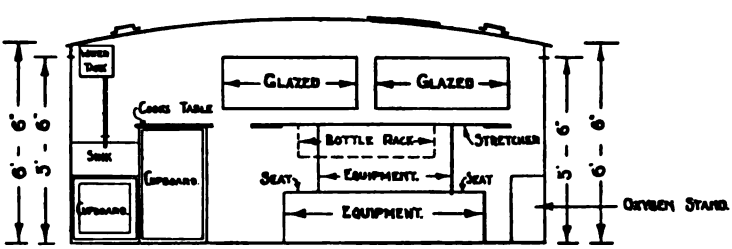
Windows are to be gas tight when closed, made of triple glass, and fitted with screens or curtains to prevent light shining through at night.

There are two ventilators in the roof as in modern buses, capable of being made gas tight.

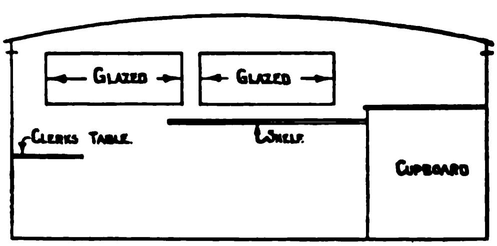
The window area (approximately 29 square feet) gives ample lighting by day. Electric light, from an accumulator beneath the floor, is available



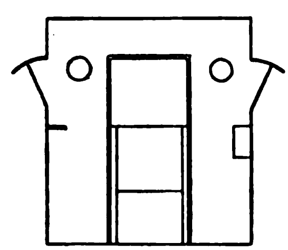
INTERIOR VIEW



OFF SIDE



NEAR SIDE



CROSS SECTION

at night. The main illumination should fall on the stretcher. The current would be generated by the engine pulling the Mobile Dressing Station.

There are cupboards and boxes, made preferably of light metal material. There is a cook's cupboard for medical comforts, crockery and cooking utensils ; the top of cupboard is used as a table by the cook. Also a

cupboard beneath the sink for cleaning materials and oil for the stove. There is a linen cupboard for pyjamas, blankets, etc.

Equipment boxes are arranged as shown in the diagrams; there is a fitment on top of the boxes to allow a loaded stretcher to rest thereon without the patient coming in contact with the box underneath.

The equipment boxes provide seats for two patients when the stretcher is not in position. Seats should be upholstered in washable leather. Medical equipment is carried in the equipment boxes.

A shelf is provided 6 feet long by 6 inches wide, 3 feet 6 inches from floor, hinged on to the near side of the body, supported by brackets, to hold bowls, trays, etc., while a patient is being dressed.

There is a table hinged to the near wall for the use of the clerk when recording particulars in the admission and discharge book, field medical card, etc.

A stand like an umbrella-stand is provided for carrying an oxygen cylinder.

A bottle rack is placed as shown on the plans, padded for carrying containers (? vulcanite) of lotions (eusol, bicarbonate, etc.) and anæsthetics. It is below the level of the loaded stretcher.

A sink 2 feet by 1 foot by 1 foot is placed as shown on the plans. The water tank above the sink is fed by pumping from a larger tank beneath the floor; the sink discharges by a pipe through the offside wall near the floor. The water tank above the sink should be 1 foot by 1 foot by 6 inches and would hold 3 gallons (approximately). The water tank beneath the floor should be accessible for cleaning, filling, and chlorinating, and should hold about 15 gallons, if possible.

Steps are not shown in the diagrams; they should be hinged to turn up at the entrance and exit as in a motor ambulance, or preferably, a ramp should be fitted at each end. The ramps should stow away beneath the floor when not in use.

The chassis should be like the usual trailer chassis, sufficiently strong to carry the weight over rough ground. The four-wheeled type is preferable, the tyres being pneumatic. The chassis should be fitted with a hand brake, operated from inside the body. The springing should be such that whilst sufficiently sprung for easy travelling, the vehicle will not sway with the movements of the personnel when the dressing station is in use halted.

The trailer could be adapted for traction by a tractor, motor ambulance, or light lorry. In an emergency it could be manœuvred into position by hand.

It is for consideration whether the mobile dressing station should be self-propelled, e.g., the chassis of a forward drive twenty-eight-seater bus could be well adapted to the needs of the body. There would be only one entrance and exit door for the stretcher in such a case, at the rear. A side entrance for personnel or walking patients could be used. The use of such a bus chassis would also permit the "cooking area" to be cut off by a

partition from the "dressing area." The self-propelled dressing station could be used for drawing "ambulance trailers" in which the patients are "retained" till evacuation is possible. Such "ambulance trailers" could also be drawn by light lorries, buses, armoured fighting vehicles, arriving and departing from the scene of action.

If in trailer form, communication between the drawing agent and the trailer dressing station would be necessary; a simple communication cord would suffice.

The medical equipment might be as follows: Suitable contents of Nos. 1 and 2 surgical panniers. Splints, Thomas, thigh and arm, with hinged rings, could be affixed to the walls on hooks. An oxygen cylinder with Haldane's apparatus would be useful. Bleaching powder and additional medical equipment for gas cases should be supplied.

Other equipment would consist of: blankets, pyjama suits, stomach warmers; medical comforts; primus stove; saucepan; kettle; drinking basins; spoons; stationery (admission and discharge book, field medical cards); slop bucket; fire extinguisher fixed to wall; an anti-gas spray.

Spare equipment, such as extra supplies, could be carried in the light lorry which carries personnel and draws the mobile dressing station.

General Uses of a Mobile Dressing Station.

A mobile dressing station provides *shelter*, which is the great essential when dressing casualties. Rain, wind, dust, heat and cold—all these are handicaps to be avoided, if possible. A mobile dressing station provides shelter where neither buildings exist nor tents can be used. This means that it can get further forward on occasions than an advanced dressing station relying on buildings for shelter.

A mobile dressing station is more mobile than the present advanced dressing station. Even with a mechanized cavalry field ambulance it takes thirteen minutes to open an advanced dressing station and nine minutes to close it. Mobility is of especial use in a retirement and there is hardly a limit to the number of positions a mobile dressing station could take up in these conditions. There is no loss of time packing up and therefore possibly more adequate treatment for the wounded.

In an encounter battle, although the mobile dressing station would be following with the M.T. in bounds, it would probably be brought into action at least as quickly as an advanced dressing station of an ordinary field ambulance could be established at present.

Another advantage is that the equipment is where it is wanted when required, and not possibly packed in more than one wagon some distance away.

It is considered that the use of mobile dressing stations would assist especially in the evacuation of wounded from armoured mobile forces, e.g., tank brigades and armoured car regiments.

A mobile dressing station would be capable of conforming with the

rate of movement of an armoured force, e.g., it can easily do 30 to 50 miles a day, or move with a brigade at 8 m.p.h. Advantage would be taken of the halts to deal with casualties; the long halts required by the brigade would be of especial service.

Armoured Car Reconnaissance.

It is suggested that the regimental medical officer should accompany the Armoured Car Regiment with, say, two motor ambulances and a mobile dressing station instead of his medical van. By keeping with the headquarters of the regiment, he receives information of the location of casualties amongst the personnel of the armoured cars reconnoitring an area. He could proceed there—escorted by an armoured car if necessary—with his mobile dressing station and an ambulance, pick up and dress his cases and rendezvous again with the cases at the headquarters of the regiment. He would know the location of the headquarters of the regiment, either by previous arrangement or by wireless received by his escorting armoured car.

Other cases might possibly be returned on the armoured cars to the headquarters of the regiment. These the regimental medical officer dresses and loads into his ambulances. He can always re-dress cases and feed his patients at halts. His staff would be his orderly and R.A.M.C. stretcher bearers and ambulance orderlies. He might want a cook extra.

'Bus Columns.

Columns for the conveyance of infantry, when accompanying an armoured force, must obviously have medical personnel and motor ambulances in order that these foot troops may keep pace with the force.

Casualties from enemy air action, raiding armoured fighting vehicles, accidents, would be expeditiously dealt with in a mobile dressing station, then passed to the accompanying motor ambulances and be carried forward with the column.

A Mixed Tank Brigade in the Attack.

With a mixed tank brigade in attack a tank regimental aid post has been suggested, and there is much in favour of it. It would at least carry the regimental medical officer and his orderly and dressings. During the short halts, when the tank companies are rallying, the regimental medical officer might be able to dress cases and possibly even collect some into his tank. If he could not collect them, he would wire back their location to "B" echelon. It would then be the duty of the O.C. Field Ambulance to direct his light sections with motor ambulances to the localities, with an escort of armoured fighting vehicles if necessary.

The tank regimental aid post is not established at present, and unarmoured vehicles, whether motor cycles or mobile dressing stations, would be unreliable in the attack. This means that casualties could not be collected until after the attack. If the attack is successful, delay, with

its consequences, would be the main adverse circumstance with which to contend.

The location of casualties would be notified by other armoured fighting vehicles during the action to Brigade Headquarters and so back to "B" echelon. The O.C. Field Ambulance at "B" echelon could pass this information forward by his motor cyclists to his sections. Alternatively, the information regarding the location of casualties could be received direct by the light sections from Brigade Headquarters if the light sections had wireless.

The light sections of the Field Ambulance should be well forward, close to "A" echelon—say, within two miles—with an escort of armoured fighting vehicles if necessary.

With the personnel of the section as at present constituted should be the regimental medical officer, regimental stretcher bearers, a mobile dressing station and, say, four motor ambulances.

The order to search the ground would come from the Brigade Commander, who alone would be in a position to know whether and when this would be feasible.

The regimental medical officer and regimental stretcher bearers would search the ground, give first aid to the wounded and concentrate them at suitable points to which the mobile dressing station could get forward or from which the field ambulance bearers could move the cases to the mobile dressing station. After being dressed, the casualties would be loaded into the accompanying ambulances and evacuated to "B" echelon. The regimental medical officer and regimental stretcher bearers would have to return to "B" echelon and would need transport—lorry or ambulance.

When the mixed tank brigade is withdrawing after action to its rendezvous with "B" echelon, it may be necessary on occasion to send up motor ambulances and a mobile dressing station to meet the brigade and relieve it of casualties returning in armoured fighting vehicles. An escort may be necessary again here. This movement would probably be to a flank out of the line of the successful advance just made by the brigade, and therefore these cases would not be collected by the light sections searching the battle ground.

It is suggested that the collection of casualties under the above conditions, where the regimental medical officer is unable to accompany his unit into action and must wait till after the action, renders the appointment of regimental medical officer obsolete, and it would be better for the work to be done by field ambulance personnel. The concentration of the brigade at "B" echelon in the intervals of fighting will also lend itself to concentration of medical work and personnel at the field ambulance. In a brigade attack it would possibly be better to consider the brigade as a whole rather than its individual components and collect from the brigade area—this again means that the regimental medical officer would not be required, but

the collecting might be performed by two or three sections of the field ambulance, a saving of officer personnel being effected.

The Approach March of a Mixed Tank Brigade.

(*a*) It does not seem possible or necessary to have medical personnel with the vanguard.

(*b*) With the mainguard, depending on its strength, should be a medical officer with his tank regimental aid post. Casualties in the van, flank or mainguards could be sought, dressed, collected or left for the people behind, their location being notified by wireless as usual.

If no armoured regimental aid post is provided no medical personnel could accompany the mainguard (nor the main body of "A" echelon). The nearest medical personnel would be at "B" echelon, unless light sections and mobile dressing stations under escort could be close up, say two to three miles behind "A" echelon. The location of casualties would be passed back as usual.

Medical Arrangements at "B" Echelon.

(*a*) *On the March.*—The field ambulance with "B" echelon would be closed. If "B" echelon is attacked from the air or by raiding armoured fighting vehicles there might be some casualties. A mobile dressing station would be of use here—the patients when dressed being transferred to the accompanying motor ambulances and carried forward on the resumption of the march.

(*b*) *Halted.*—The field ambulance, centrally sited in the perimeter camp, would open up the main dressing station, send out motor ambulances as necessary and prepare to receive casualties.

If dressing stations could not be opened at once owing to rapid movement of the force, casualties would be much better attended to in mobile dressing stations than in motor ambulances.

If the main dressing station could be opened, the mobile dressing stations would not be as necessary, but even here they might be used as dressing rooms or operating theatres, especially if patients are retained some days at "B" echelon before it is possible to evacuate them.

The personnel of the Headquarters of a cavalry field ambulance should possibly be on a surgical team basis in view of the retention of patients for some days.

(*c*) *Evacuation from "B" Echelon.*—However long retained, it will be possible at some stage to evacuate the patients from "B" echelon. Long distance evacuation in convoys taking two to three days is envisaged. Mobile dressing stations would be easily convertible to the role of travelling operating theatres accompanying the convoys of stretcher cases in motor ambulances.

Walking wounded (if these had not all become stretcher cases) might

have to be evacuated in returning lorries—here again convoys should be accompanied by medical personnel and mobile dressing stations.

Twenty-eight seater buses and lorries might be converted to the carriage of stretchers, if suitable apparatus were designed and carried, and an economy in motor ambulance transport thus effected.

Conclusion.

It is hoped that the utility of a mobile dressing station in war has been demonstrated. In peace, on manœuvres, it should also prove useful. In civil life the mobile dressing station might be found useful whenever large bodies of people gather together, e.g., at race-courses, etc. It might be of service on the roads for accidents; at large fires; mine and train accidents, etc. Stationed at the main fire station of a large town frequent opportunities for its use would be found. The Voluntary Aid Societies and motoring organizations might be persuaded to adopt the idea and construct experimental dressing stations.

No doubt modifications of the actual dressing station shown in the plans could usefully be made, but it is suggested that the underlying principle of a really mobile dressing station could be adopted with advantage to the efficiency of the collection, treatment and evacuation of wounded.

A VERY EFFICIENT TYPE OF SWIMMING BATH.

By Major R. A. ANDERSON,
Royal Army Medical Corps.

Possibly other hygiene officers, like myself, have been asked while serving abroad to advise on the erection of efficient swimming baths. It is hoped the following notes may be of use to them as it is difficult to obtain plans of a modern plant when on foreign service.

A very efficient type of swimming bath, with a capacity of 64,000 gallons, has been recently erected in the Y.M.C.A. at Kowloon (Hong Kong). The

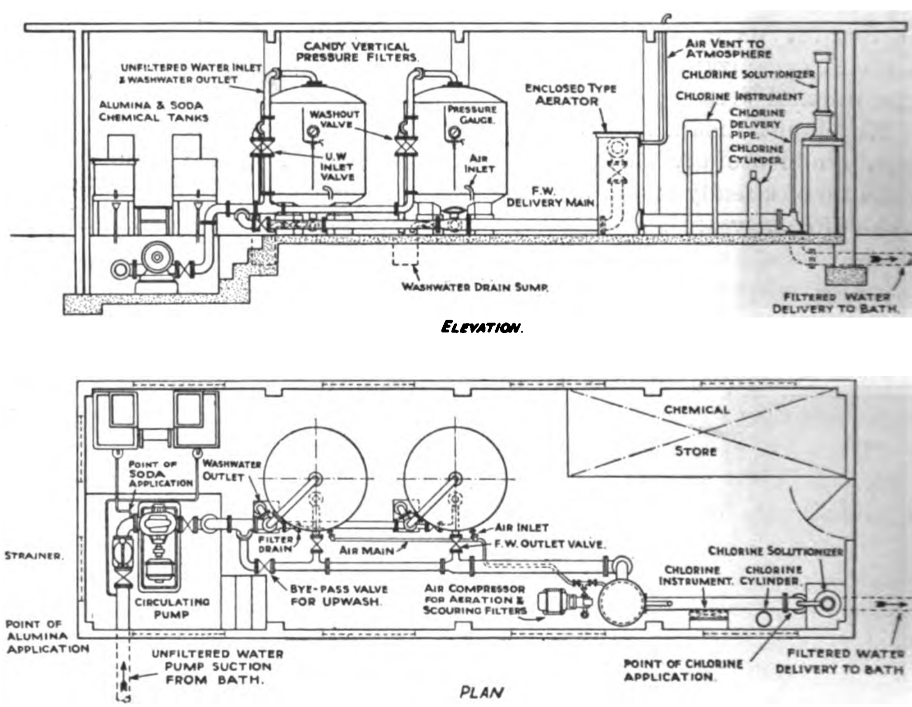


Fig. 1.

bath is fitted up with the most up-to-date filtering, aeration and sterilization plant.

The general outline of the scheme is as follows :—

Fresh water from the drinking water supply of Hong Kong is used. The water passes from the bath in a constant circulation through an opening at the bottom of the bath, near the deep end, then through a coarse screen to a pump where it is pumped into pressure filters of the "Candy type." Before entering the filters, alum is added to the water in order to form a gelatinous precipitate on the surface of the filters. After

passing through the filters the water passes (through the heater in winter) to the aerator, where it is aerated by an air compressor, and finally, before reaching the bath again, it is treated with chlorine and enters the bath at the shallow end.

In addition, owing to the tendency for some of the heavier particles of dirt, etc., to settle out on the bottom of the bath and remain there, a separate suction pump with a nozzle, capable of being moved all over the bottom of the bath, is supplied and used daily.

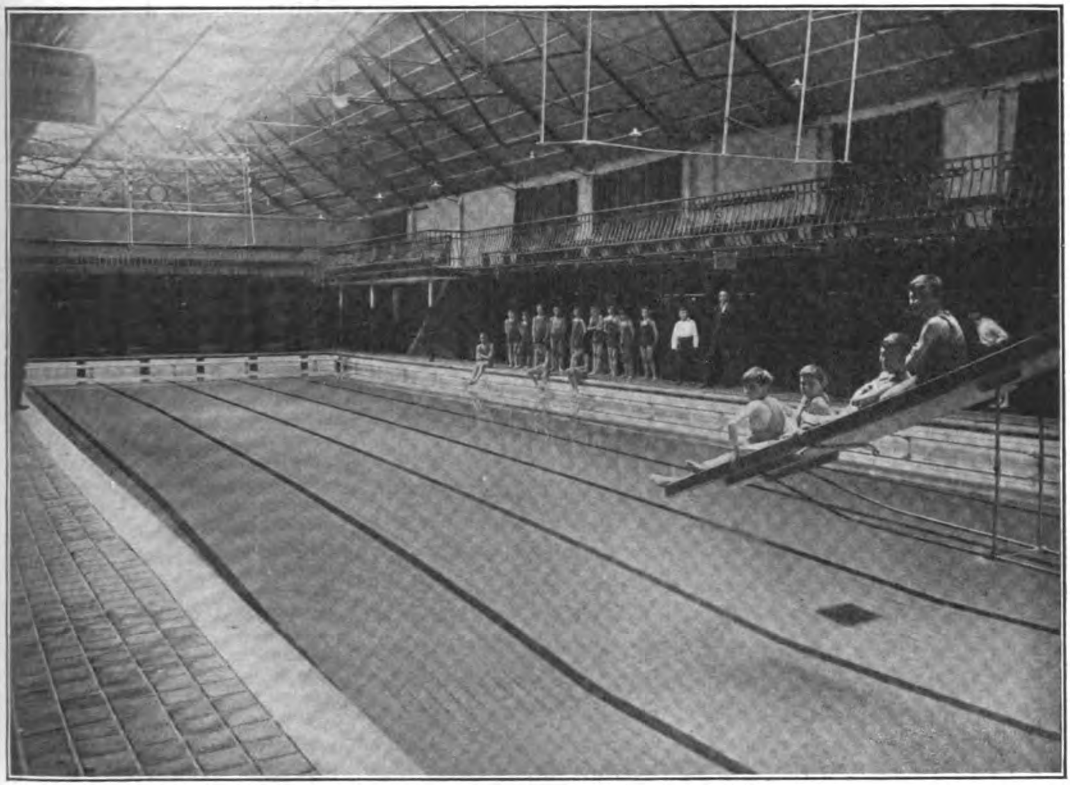


Fig. 2.

A certain amount of fresh water is added daily to replace loss by evaporation, etc.

The water is circulated from 5 a.m. to 10 p.m. daily.

Fig. 1 shows the general lay-out of a complete installation.

This swimming bath is run on "the constant filtration" method, which is a considerable improvement on the former practice of filling swimming baths two or three times a week. Among obvious advantages are: (1) Economy in water; (2) the water is at all times under direct control; it is filtered, aerated and, after chlorination, returned to the bath, clean,

sparkling and bacteriologically pure; the water in the bath completes the cycle every six to twelve hours; (3) economy in coal consumption for heating, as owing to the fact that the same water is used only a few degrees of heat are lost.

Modern dressing rooms are supplied, separate for the sexes. Each individual is required to wash with soap and water under a hot shower spray in a cubicle before being allowed into the bath.

Various notices are displayed requesting bathers to observe the rules of hygiene.

The bath has a special type of spitting trough, with separate drains, fixed all round the edges.

An average analysis of the bath water weekly is :—

Total solids	5·4	parts per 100,000
Free ammonia	0·0011	,, ,,
Free chlorine	0·002	,, ,,
pH	Value 7·5	

The photograph (fig. 2) shows the swimming bath. The bath and floors are covered with white tiles, also the spectators' gallery; there is overhead lighting; the diving boards, water chutes and water polo goals are movable fittings, so that the bath can be used for racing purposes. The diving boards can be tilted up flat against the walls.

The water is drawn from the deep end of the bath by a centrifugal pump, which can be driven by any available source of power. The most convenient is a direct couple with an electric motor, but where electric current is not available a steam or oil engine can be used instead.

Fig. 3 shows the alumina apparatus, which is self-explanatory.

The floating arm contains a vulcanite regulator on the top for setting the rate of flow. The orifice of the regulator is always at the same level beneath the surface of the solution and consequently the discharge remains constant, irrespective of the depth of solution in the tank.

The tanks are made of wood, lined with lead to resist corrosive action.

Where necessary, when dealing with waters which have not much temporary hardness, soda can be added from a similar apparatus, except that the tanks are made of galvanized iron instead of wood.

To remove large particles, such as fluff from bathing costumes, etc., the strainer can be cleaned by lifting the cover and removing the perforated strainer. The cover is secured by a single lever quick-acting shutting device for this purpose.

The filter may be either a pressure or gravity type, and in choosing between them the main considerations are the capacity of the plant and the level of the site available. For large baths gravity filters are cheaper to instal. Pressure filters have the great advantage that they can be placed at any level, whereas gravity filters must be placed so that the water can flow by gravity either from the bath into the filters or else from the filters

back to the bath, i.e., the filters must be either entirely below or entirely above the level of the bath.

The filter consists of a bed of specially graded sand and gravel supported on a false floor, in which are fitted the Candy patent nozzles. The water admitted at the top, filters downwards through the sand and out through a pipe at the bottom.

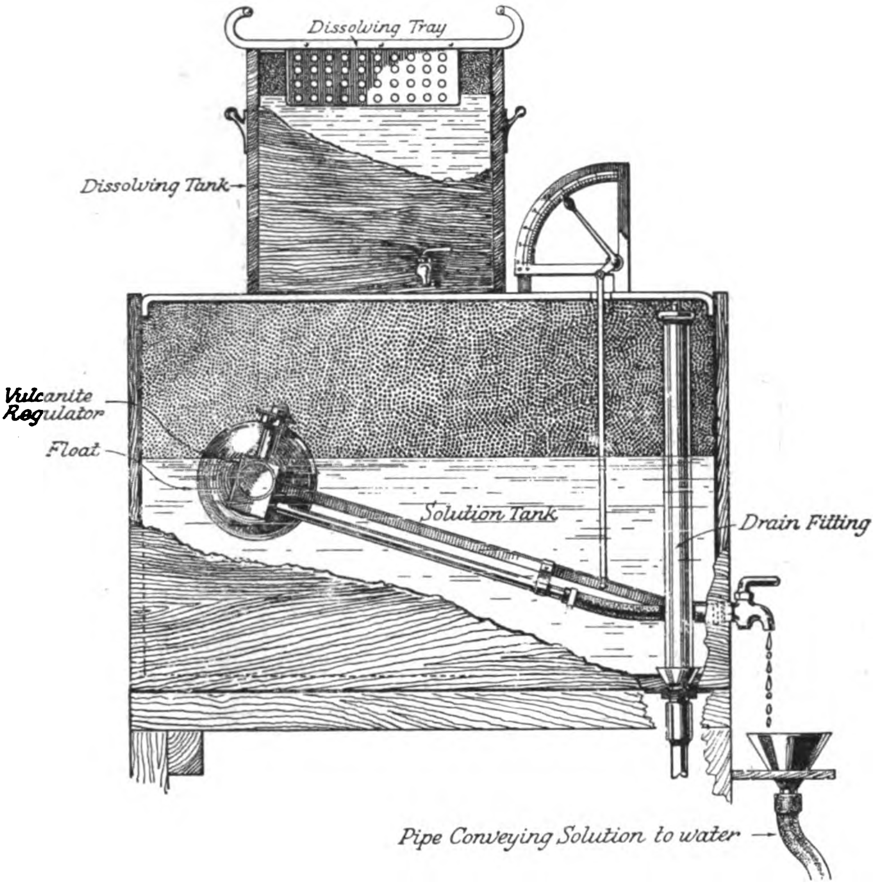


FIG. 3.

After twenty-four to forty-eight hours working, sufficient dirt will have accumulated in the filter to necessitate cleaning. The cleaning is effected by an upward wash of water accompanied by a violent agitation or scouring of the sand. This scouring is obtained by either of the following methods :—

(*a*) The air scour, in which compressed air at five to ten pounds per square inch pressure is blown into the bottom of the filter.

(*b*) The hydraulic scour, in which jets of water are discharged from an

arm placed just above the surface of the filter bed and rotated by hand mechanism when the filter is being cleaned.

The nozzles in the false floor serve to collect the filtered water evenly and also to distribute evenly the upward washwater and the air. In the air scour type the nozzles have stems projecting below the false floor. A small hole is provided at the top of the stem just sufficient to pass the correct quantity of air. The air when blown in rises to the underside of

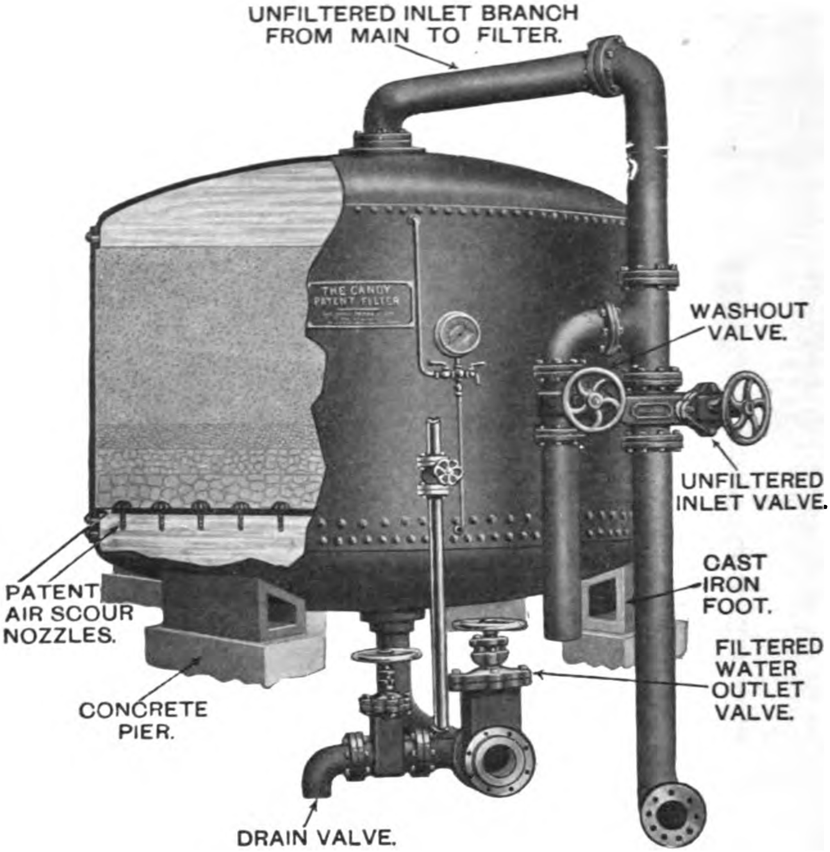


FIG. 4.—Section of Candy Air-scoured Pressure Filter.

the false floor and passes up through the small holes into the filter, the main mouth of the stem being automatically sealed with water. The upward washwater passes up through the main mouth of the stem.

The even distribution of the air and water for cleaning is most essential as otherwise the filter will become patchy and its effective area will be reduced. With the Candy system the whole of the bed is cleaned and no dirty patches are left anywhere.

The quantity of washwater required is about one per cent of the water treated, and either the bath water or town water, or both, can be used. In

large plants it is better to use the bath water for cleaning the filter and to add fresh town water as make-up water in the bath.

A section of an air scour pressure filter is shown in fig. 4.

The water after passing through the filter is perfectly clear and bright, but there still remain two or three further operations to complete the treatment. The water passes into an open aerating tank and a continuous stream of air is blown up through it by a small air compressor. This air compressor is driven either by its own motor or by a belt from a pulley on the pump shaft. The object of the aerator is to release any gases dissolved in the water and to restore its natural sparkle. For this purpose an open aerator is of much greater benefit than an enclosed one. In the latter type there are no means by which the dissolved gases can escape. If economy is essential the aerator and compressor may be omitted without sacrificing the main purpose of the plant.

The only remaining part of the treatment is to supply the water with the necessary heat to make up for heat losses. It is often erroneously supposed that the installation of a continuous filtration plant appreciably increases the normal heat loss. A moment's consideration will show that the loss of heat that occurs during the short period in which the water is circulating through the filtration plant cannot be at a much greater rate than when the same water is standing in the open bath. The length of time for one portion of water to pass right through the system is a matter of minutes only, whereas for a further six to twenty-four hours that water is in the bath. There is, however, a slow but steady loss of heat in all cases where the bath is maintained at a higher temperature than the surrounding atmosphere. This loss of heat will be only a very few degrees per day and will be exactly the same as when the bath was filled with clean water by the old method.

In existing baths, where there is already an arrangement for heating the water by blowing steam into it, there is no need to instal any additional heating apparatus. In new baths a steam calorifier can be installed as an integral part of the plant.

It is every day becoming more possible to supply electrically the small amount of heat required. Where the Municipal Corporation own both the baths and the electrical power station, arrangements can often be made that are advantageous to both concerns. The saving of labour at the bath is considerable as no steam boiler has to be attended to. The electric heating elements are placed either in the bottom of the filter or in the aerating tank or in a separate vessel provided for the purpose. From the point of view of the power station the load is an ideal one as it can be arranged to be on continuously during the day and night and turned off during the few hours of the peak load. Under these conditions, the electric current can often be economically supplied at ½d. per unit or even less.

Before again reaching the bath the water is treated with a small dose of chlorine, which, by absolutely destroying the bacteria, prevents risk of

infectious diseases being spread by an infected bather. The chlorine can be used either in the form of chlorine gas or chloride of lime (bleaching powder), and the usual dose is ½ to 1 part of free chlorine per 1,000,000 parts of water (5 to 10 pounds free chlorine per 1,000,000 gallons of water).

The bleaching powder apparatus is similar to the alumina apparatus, except that the dissolving tank is replaced by a mixing churn; and for a continuous twenty-four-hour run the solution tank is supplied in duplicate, so that the solution can be settling in one tank while it is being discharged from the other.

The plant installed in the Y.M.C.A. cost about 15,000 Hong Kong dollars—this does not include the swimming bath—roughly about £1,000 to £1,500.

The bath has only been opened a few months and 45,000 individuals up to date have used it. It is well patronized by men of the Services.

I am indebted to J. H. Hunt, Esq., Secretary of the Y.M.C.A., for his kindness in demonstrating the details to me, to the Candy Filter Co. Ltd., Hanwell, who supplied the plant, for the diagrams and photograph, and to Colonel C. D. Myles, O.B.E., A.D.M.S., China Command, for permission to send this article for publication.

AN INVESTIGATION INTO THE BACTERIAL POLLUTION OF SWIMMING BATHS.

With special reference to:—

(1) The normal bacterial flora, the pathogenic organisms present and their importance in relation to the spread of disease.

(2) The viability of certain micro-organisms, chiefly of the coli-typhoid-dysentery group, in fresh-water and sea-water.

(3) A study as to the presence of bacteriophage in fresh, sea, and sea-bath waters.

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Section I.

THE PATHOGENIC ORGANISMS THAT CAN BE ISOLATED FROM SWIMMING BATHS, WITH SPECIAL REFERENCE TO SEA-WATER BATHS AND THEIR IMPORTANCE IN THE SPREAD OF DISEASE.

(*Continued from p.* 94.)

The Anaerobic Bacilli in Water.

In addition to looking for aerobic bacilli present in sea-bath water, a series of fifty different experiments was made in an attempt to isolate any anaerobic bacilli present in the water. Many writers had described the fact that *Bacillus entiritidis sporogenes* was frequently found in fresh-water bathing pools. This organism, being an inhabitant of river water and thus finding its way into the sea, might quite possibly be found in sea-bathing water, especially as being a spore-bearing organism it is able to survive longer in water than *B. coli*. An attempt was also made to see whether or not *Clostridium tetani* could be isolated.

Methods adopted to isolate C. welchii.

Method 1.—(1) One hundred cubic centimetres of the sample of bath water were centrifuged for one hour.

(2) The deposit was then resuspended in one cubic centimetre of sterile saline.

In the first ten experiments 0·2 cubic centimetre of the deposit, and in thirty experiments the whole 1 cubic centimetre, was introduced into freshly boiled tubes of litmus milk.

These tubes were then heated to 80° C. for ten minutes and were then incubated for two days in a McIntosh and Fildes anaerobic jar.

In these forty experiments no stormy fermentation was seen in any tubes.

Therefore, according to these experiments (forty in number), *C. welchii* was absent.

Method 2.—In this method 10 cubic centimetres of the sample of water taken from the sea-water swimming pool were added to freshly boiled tubes of litmus milk. The tubes were then heated to 80° C. for ten minutes. At the end of that time they were incubated anaerobically for two days in a McIntosh and Fildes anaerobic jar, and then examined.

By this method ten experiments were carried out, and in only one of these experiments was stormy fermentation found. Therefore, in this series of experiments *C. welchii* was only found on one occasion.

This result, namely, that in only one experiment of the fifty carried out was *C. welchii* found, appeared to be peculiar, especially in view of the fact that this bacillus had been found in large numbers of samples of fresh-water bath water. Again, it seemed strange that it should not have been found on forty occasions when the deposit from 100 cubic centimetres of water was used, and yet on the only occasion that it was found, it was obtained from 10 cubic centimetres of water which was not centrifuged.

It appeared to the writer worth while investigating the viability of *C. welchii* in sea-water, and accordingly the following experiment was commenced :—

(1) A known live culture of *C. welchii* was taken, this was seeded over four agar plates with a sterile pipette.

(2) These plates were then incubated for two days anaerobically in a McIntosh and Fildes jar.

(3) At the end of this period the growth was washed off by sea-water, and the emulsion so made was put into a flask of sea-water and was kept at 37° C.

(4) On the following and each successive day 5 cubic centimetres of this sample were taken and added to freshly boiled litmus milk, and the remainder of the experiment carried out as described in Method 2.

The organism was found to be viable in sea-water up to ten days, this being the latest date of testing possible.

C. tetani.—A series of twenty experiments was also carried out with a view to seeing whether or not *C. tetani* could be isolated from the bath water after use.

In the first series (10) of these experiments the centrifuged deposit of 100 cubic centimetres of the water was resuspended in 1 cubic centimetre of sterile saline and added to broth tubes; in the second ten experiments 10 cubic centimetres of the raw water from the sea bath were added to tubes of broth.

In both cases these tubes were heated at 80° C. for ten minutes to remove any aerobic organisms.

They were then incubated for forty-eight hours in a McIntosh and Fildes jar and examined. The broth cultures were then plated out on agar plates and incubated for forty-eight hours and again examined.

Microscopic evidence of any organism resembling *C. tetani* was not obtained.

An Investigation into the Bacteria, more Especially the Pathogenic Bacteria found in Sea-bath Water after Use.

The writer was unable to find any information as to the pathogenic or other bacteria found in sea-water bathing pools, and therefore, with a view to trying to find out what organisms were present, carried out the following series of investigations:—

Method Adopted.—(1) 100 cubic centimetres of the daily sample of sea-bath water were centrifuged for one hour and the deposit resuspended in 1 cubic centimetre of sterile saline.

(2) 0·1 cubic centimetre of this material was then inoculated on to (1) agar plates; (2) blood-agar plates; (3) MacConkey plates.

(3) 0·1 cubic centimetre was also inoculated on to tubes of Loeffler's serum.

(4) A second 100 cubic centimetres were centrifuged and the deposit resuspended and tested for anaerobic organisms, as already described.

(5) The plates referred to in paragraph (2) were incubated at 37° C. for twenty-four hours, and at the end of that period different colonies were picked from these plates and inoculated on to agar slopes.

(6) These agar slopes were then incubated for twenty-four hours. The cultures were stained and examined morphologically, and biochemical and, where necessary, agglutination tests carried out.

(7) Wherever it was considered necessary to adopt any special technique in order to attempt to identify these organisms more particularly, this was done.

(8) At the end of this section there will be found a series of tables showing the results of examining samples of water, and an attempt so far as possible to identify the organisms found to be present.

(9) It will, I think, be recognized that in many cases it is not possible actually to identify the organisms by name, and therefore all that is attempted in this paper is to give a certain number of facts with regard to each organism.

(10) Portions of the deposits from 100 cubic centimetres of water after centrifuging and resuspending in 1 cubic centimetre of sterile saline were inoculated into mice and guinea-pigs for evidence of the presence of pneumococci, hæmolytic streptococci, tubercle bacilli, leptospira, etc.

These actual animal inoculations were carried out by Dr. Berry, Lecturer in Public Health, and Dr. J. Smith, the City Bacteriologist, Aberdeen, the writer not being in possession of the necessary licence to carry out this work.

In all cases the results of these inoculations were negative.

Results of These Investigations.

The Hæmolytic Streptococci.—Griffiths, in the Ministry of Health Circular on Public Swimming Pools (His Majesty's Stationery Office), describes the isolation on one occasion of hæmolytic streptococci by inoculation of a mouse with the water.

During the present investigation by inoculation on to blood-agar of 0·1 of the deposit from 100 cubic centimetres of water after centrifuging for one hour, a hæmolytic streptococcus was recovered on three occasions. These cocci were obtained in pure culture on blood-agar slopes, and their biochemical reactions were as under :—

Glucose	Acid only
Lactose	" "
Saccharose	" "
Mannite	Negative
Dulcite	"
Salicin	"

The isolation of hæmolytic streptococci from such relatively small quantities of water appears to the writer to be important as indicating their presence in considerable numbers in the bathing pool.

It would therefore appear that sea-water bathing pools may be a source of infection with *Streptococcus hæmolyticus*, and that sore throats, scarlet fever and other diseases may thus be spread by this agency.

Staphylococci.—In this investigation *Staphylococcus albus* was found on practically all occasions, and gave the following sugar reactions :—

Glucose	Lactose	Saccharose	Mannite	Dulcite
A	—	A	—	—

This organism liquefied gelatin and was non-hæmolytic.

On a large number of occasions *Staph. aureus* was also found and gave the same sugar reactions as the *Staph. albus*, liquefied gelatin and was non-hæmolytic.

Gram-negative Cocci.—Another organism that was frequently found was a Gram-negative diplococcus. This gave a drab or nearly colourless growth on agar, did not ferment any sugars, usually did not liquefy gelatin, and was definitely non-hæmolytic. It is presumed that this organism is the Gram-negative diplococcus that has already been described by Graham Forbes.

Non-hæmolytic Streptococci.—In many samples a streptococcus giving fine colourless colonies on agar and fermenting no sugars was found, and it is presumed that this organism was *Str. salivarius*.

On eleven occasions in this investigation a mannite-fermenting streptococcus was isolated which was probably *Str. fæcalis*.

Bacillus pyocyaneus.—Many writers have described the isolation from fresh-water baths of *B. pyocyaneus*, but although the writer must in the course of these investigations have inoculated at least 300 to 400 tubes of gelatin, this organism was never found on any single occasion. Whether or not sea-water is definitely inimical to this organism the writer is not in a position to state, but the fact remains that this organism was never found.

Diphtheroids.—A few diphtheroids were isolated. This is not remarkable, in view of the fact that these are commonly found in the normal throat, and of the amount of spitting that must take place in these public baths.

Members of the B. coli *Group.—Bacterium coli* types were isolated from every sample, but although careful search was made, no other members of the coli-typhoid-dysentery group were isolated, not even when enrichment methods were tried.

Anaerobes.—Of the anaerobic group of organisms *C. welchii* was the only one isolated, and this in only one of fifty experiments as described in the text.

Sporing Aerobes.—B. subtilis was isolated on a few occasions.

Chromogenic Bacteria.—A large number of organisms of the chromogenic group were isolated as might be expected.

The most important finding in these experiments was the isolation from a relatively small quantity of water of a true *Str. hæmolyticus*, which, as far as the writer is aware, has never been recovered prior to this by any investigator into the pathogenic bacteria in swimming-bath water.

Summary and Conclusions as to the Amount of Pollution in Swimming Baths and its Importance as Affecting the Public Health.

The source of pollution of swimming baths may be divided into external and internal.

By external pollution is meant pollution which is introduced from an outside source, either brought in by the water itself or by drainage or sewage gaining entrance as a result of some error in construction, such as faulty lining to the sides or bottom of the bath or no lining at all. In the former case, the water may have become contaminated by sewage matter in the proximity, in the latter from the subsoil water and surface drainage in the neighbourhood.

By internal sources of pollution is meant the actual contamination of water or premises chiefly by the bathers themselves. These pollutions may be: (*a*) Chemical, e.g., saliva, urine, fatty and other acids from the skin, etc.; (*b*) bacteriological, e.g., organisms introduced from the skin, nasopharynx; (*c*) by bathing costumes, towels, etc.

Pollution from Bathers.—It is obvious that the greatest amount of the pollution introduced into a swimming pool must come from the bathers themselves, even in those baths where the rule is in force of making each bather wash the body and feet in soap and water prior to entering the bath. In the majority of cases it is only the feet that are washed.

Apart from any pollution from the external surface of the body, such as hair and skin, it must also be admitted that practically every person using the bath must occasionally spit into the bath as a result of getting the mouth full of water whilst bathing. There is also no doubt that a large amount of material from the nose must also be introduced at the same time.

A great amount of contamination of the water must take place by the introduction of urine.

Further, sweat, fatty acids from the skin, dead epithelium, and dried up dirt, must also add to the pollution of the water.

Many of these pollutions added to the water, maintained as it is at a temperature of approximately 70° to 74° F., must tend to make the water into a culture medium, and therefore, for a time at any rate, many of the organisms may multiply and grow in this media. This has been asserted by Mallmann in the case of *Bact. coli.* According to the report of the County Medical Officer of the London County Council in 1927, each "not very clean adult bather" imparts to the bath water 0·8 gramme of nitrogen in all forms, and 1·3 grammes of chlorides.

It is thus clear that there must be a very considerable quantity of pollution both chemical and bacterial added to the water of these public swimming baths, and the question therefore naturally arises as to what is the effect of this pollution on the bathers and what are its dangers to the public health.

First of all, it appears that one must admit that the possibilities of infection do exist, as has been shown by the isolation of certain pathogenic bacteria from sea-bath water.

At the same time, even taking into account the enormous numbers of people who use these swimming baths in the course of a year, it can probably be stated with accuracy that not a single recorded authentic epidemic can be definitely attributed to swimming pools, except in cases of gross pollution, which under modern hygienic conditions should never have taken place.

Intestinal Diseases.—In the case of the small epidemic of enteric fever described by the late Dr. R. J. Reece, which occurred at the Royal Marine Depot at Walmer, the intake pipe of the bath was only 100 and 500 yards respectively from two outfall sewers into which untreated sewage containing untreated enteric excreta was discharged. There is little cause to wonder, therefore, at this outbreak.

The only other intestinal infection mentioned in the literature is that recorded by Jaeger in 1892, of ten cases of severe diarrhœa occurring in soldiers bathing in the Danube; the evidence on which this report is based is most inconclusive.

The position, therefore, is that in the whole of the literature there are only two cases of epidemics of gastro-intestinal disease, one of which is very inconclusive, the other definitely due to contamination of the bath water with sewage.

Respiratory Diseases.—Here again there is no satisfactory evidence that swimming pools are the cause of grave disease or numerous cases. Certain diseases have been attributed to swimming baths, e.g., Ogden describes cases of pneumonia, but these cases were much more likely to be due to other causes which lowered the vitality of the patient who was at the time carrying the pneumococcus, and not to any definite infection from the bath itself. It must be remembered that swimming is a fairly strenuous exercise, and further, that sudden immersion in water at a temperature of 74° F. in cases who may quite easily have some mild temperature due to coryza or some other infective process, will naturally tend to lower their resistance

and thus give the infective organism they are carrying a better chance to establish its sway.

Skin Infections.—Cases of furunculosis, scabies, ringworm and pediculosis have been attributed to swimming-pool infection. As regards the last three, from the very nature of the mode of infection it would appear far more likely that these infections were caused rather by the common use of improperly cleansed towels or costumes, and certainly not by bath water itself.

As regards furunculosis, the *Staph. aureus* can definitely be isolated from bath water, but in the absence of proof that furunculosis is more common amongst those people who use public swimming-baths than amongst the general population, it is hard to believe that swimming-bath water is a cause of this condition.

Infectious Diseases.—There is practically no record of any of the ordinary infectious diseases being spread by swimming-baths, yet their mode of dissemination by "droplet" infection suggests them as the diseases most likely to be spread by this agency. There must be in the course of a year a very large number of persons, especially children, using public baths who are either (1) actual mild cases of infectious diseases in the early and unrecognized state, or (2) carriers of organisms of such diseases, e.g., hæmolytic streptococci, diphtheria bacilli, etc.

Again, the state of overcrowding, intimate mixing of the people, expectoration at close quarters in the bath, etc., may be more important than the presence of the causative organism in the water itself.

A small epidemic of scarlet fever was recently attributed to infection from a bath. The writer has isolated hæmolytic streptococci on three occasions from 100 cubic centimetres of sea-bath water, which must have meant that there was a large number of such organisms present in the bath, yet, so far as could be ascertained, no cases of this infection occurred. Hæmolytic streptococci having been isolated from a public bath, it appears that the possibility of infection must be admitted. On the other hand, water is not by any means the normal source or habitat of organisms of the infectious group of ordinary fevers, and it would appear that any actually accidentally introduced into water must be in a very unhealthy and attenuated state after immersion, and would tend rapidly to die out. Experimentally, when hæmolytic streptococci in large numbers were introduced into sea-water and kept at 37° C. they could only be recovered up to forty-eight hours. Therefore the chances of spread of this organism by this method would appear to be remote.

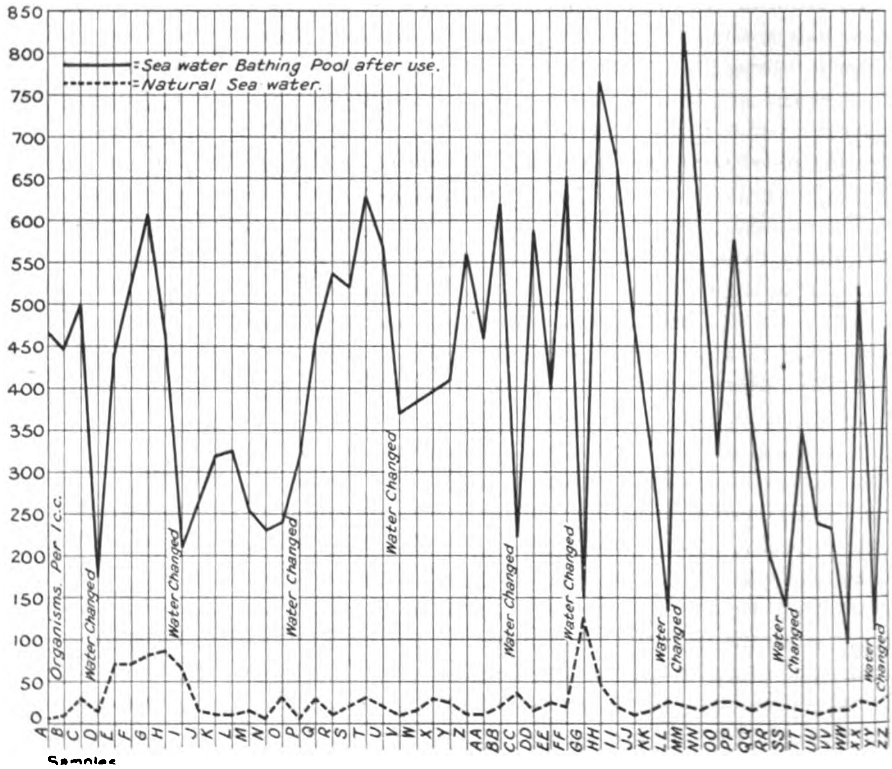
No true diphtheria organism was isolated from sea bath-water, though on a few occasions diphtheroid organisms were found. This is not surprising considering that diphtheroid organisms are fairly frequently found in the normal throat.

The possibility of the spread of a disease like cerebrospinal meningitis can be dismissed in a word. The germ is very delicate, and the temperature of the water too cold to allow it to live. These points together with

the fact that it has never been recovered from swimming-pool water are sufficient to prove that such a disease cannot be spread in this way.

Otitis.—The writer, having reviewed the evidence on this subject, is not by any means convinced that this condition is directly due to definite infection from bath water.

What is a more likely explanation is that the act of bathing, especially in those who are not accustomed to it, may cause some difference in osmotic pressure in the area of the drum, with resultant stretching or



GRAPH A.—Chart shewing the difference in counts between Natural Sea-water and water from Sea-water Bathing Pool after use—the samples being taken on consecutive days, except Sunday, in both cases over the same period.

swelling of the drum, which may cause a small abrasion or increase in size an existing one, and this abrasion having occurred, infection by an organism then takes place. That the organism actually comes from the water itself, although *Staph. aureus* is present, is very doubtful when one considers the many other sources from which it may be derived. The bather is much more likely to introduce the organism by such operations as trying to clear out the ear with a dirty finger-nail, or by using dirty handkerchiefs. Though *Staph. aureus* is found in swimming-pool water, it probably exists there in a weak and attenuated form not being in its normal habitat.

CONCLUSIONS.

(1) While the possibility of infection from swimming-pool water does exist, the present investigation corroborates the previous findings, that no disease in epidemic form is spread by this agency.

(2) Although the possibility of individual cases arising from this source must be admitted, the numbers of cases are negligible compared with the numbers of bathers.

(3) The danger of even individual cases arising can be entirely eliminated by chlorination of the water—a procedure which is essential in all cases of public baths. Filtration alone as carried out is insufficient. This would appear to be proved by the work of Dr. Mallmann referred to in the text.

(4) Such a healthy exercise as swimming is to be encouraged from the point of view of the public health, but the inadequate means adopted in some places to ensure a pure water discourages the public from taking full advantage of the swimming baths provided.

TABLES SHOWING THE MORPHOLOGY, BIOCHEMICAL AND OTHER REACTIONS OF ORGANISMS ISOLATED FROM SEA-WATER BATHING POOLS AFTER USE.

BATH-WATER SAMPLE. A.

No.	Nature of growth	Morphology	Reaction to Gram's stain	Biochemical reactions						Gelatin liqu.	Hæmolysis
				Glucose	Lactose	Saccharose	Mannite	Dulcite	Salicin		
1	White	Staphylococcus ..	+	A	—	A	—	—		+	—
2	Yellowish	,, ..	+	A	—	A	—	—		+	—
3	Colourless pin point	Streptococcus ..	+	A	A	A	—	—		+	—
4	White	Staphylococcus ..	+	A	—	A	—	—		—	—
5	Opaque	Streptococcus ..	+	A	—	A	A	—		+	—
6	Drab colour ..	Bacillus	+	A	—	A	A	—		+	—

BATH-WATER SAMPLE. B.

No.	Nature of growth	Morphology	Reaction to Gram's stain	Biochemical reactions						Gelatin liqu.	Hæmolysis
				Glucose	Lactose	Saccharose	Mannite	Dulcite	Salicin		
1	Greenish white ..	Bacillus	—	A	—	—	—	—		+	—
2	Creamy white ..	Bacillus	+	A	—	A	A	—		+	—
3	Creamy white ..	Diplococcus	+	A	A	A	A	—		+	
4	Creamy white ..	Bacillus	—	A	—	—	—	—		+	—
5	Opaque	Streptococcus	+	A	—	A	A	—		+	—
6	White, dry, wrinkled	Bacillus, aerobic spore-bearing	—	A	A	A	A	—		+	—
7	Creamy yellow ..	Staphylococcus.. ..	+	A	—	A	—	—		+	—

BATH-WATER SAMPLE. **C.**

No.	Nature of growth	Morphology	Reaction to Gram's stain	Biochemical reactions						Gelatin liqu.	Hæmolysis
				Glucose	Lactose	Saccharose	Mannite	Dulcite	Salicin		
1	White	Bacillus	—	A	—	—	—	—		+	—
2	Creamy white	Staphylococcus	+	A	—	A	—	—		+	—
3	Yellow	,,	+	A	—	A	—	—		+	—
4	Greenish white	Bacillus	—	A	—	—	—	—		+	—
5	Drab coloured	Coccus (Streptococcus)	—	—	—	—	+	—		+	—
6	,, ,,	Bacillus	—	—	—	—	—	—		+	—
7	Colourless fine	Streptococcus	+	—	—	—	—	—		+	—
8	Creamy white	Staphylococcus	+	A	—	A	—	—		+	—

BATH-WATER SAMPLE. **D.**

No.	Nature of growth	Morphology	Reaction to Gram's stain	Biochemical reactions						Gelatin liqu.	Hæmolysis
				Glucose	Lactose	Saccharose	Mannite	Dulcite	Salicin		
1	Greenish	Small bacillus	—	A	—	A	A	—		—	—
2	Colourless, clear	Streptococcus	+	—	—	—	—	—		+	—
3	Yellow	Staphylococcus	+	A	—	A	—	—		+	—
4	Yellow	Diphtheroid bacillus	+	A	—	—	—	—		+	—
5	Colourless	Diplococcus	—	—	—	—	—	—		+	—
6	Drab coloured	Bacillus	—	A	—	—	—	—		+	—
7	Colourless, clear	Diplococcus coccus	—	A	—	—	—	—		+	—
8	Clear spreading	Spore-bearing bacillus	+	—	—	—	—	—	—	+	—

BATH-WATER SAMPLE. **E.**

No.	Nature of growth	Morphology	Reaction to Gram's stain	Biochemical reactions						Gelatin liqu.	Hæmolysis
				Glucose	Lactose	Saccharose	Mannite	Dulcite	Salicin		
1	Yellow colour	Staphylococcus	+	A	—	A	—	—		+	—
2	Creamy white	,,	+	A	—	A	—	—		+	—
3	Whitish	,,	+	A	—	A	—	—		+	—
4	Drab coloured	Diplococcus	—	—	—	—	—	—		+	—
5	Drab coloured	Bacillus with vibrio-like forms	+	—	—	—	—	—		—	—
6	Brownish red	Bacillus	—	—	—	—	—	—		—	—
7	White waxy	Diphtheroid bacillus	+	A	—	A	A	—		+	—
8	Drab coloured	Coccus	+	—	—	—	—	—		—	—
10	Drab coloured	Diplococcus	—	—	—	—	—	—		—	—

(To be continued.)

FURTHER OBSERVATIONS ON THE BEARING OF ATMOSPHERIC HUMIDITY ON OUTBREAKS OF CEREBROSPINAL MENINGITIS (ALEXANDRIA, 1930-1932).

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In the August number of the Journal of the Royal Army Medical Corps, 1932 [1], I gave an account of the steps that led me to enunciate the humidity theory of cerebrospinal meningitis, which connects outbreaks of the disease with high atmospheric humidity, particularly indoors, when carrier-rates are high.

The present communication relates to Alexandria, where during the past two years the disease has shown a marked recrudescence, as elsewhere in Egypt. Authoritative figures for the decade 1920-1929 give 327 cases with 209 deaths for the whole of Egypt, or an average of 33 cases a year [2]. The year 1930 is marked by an increase to 98 cases with 58 deaths, and the year 1931 by a startling increase to 871 cases with 510 deaths. The corresponding figures for Alexandria are: 1930-1931 (July-June), 77 cases with 45 deaths; 1931-1932, 55 cases with 32 deaths.

Since the climate of Alexandria is characterized by high humidity, which is greatest in summer (June-August) and least in winter (November-February), and as this is the reverse of what happens in Cairo and the interior of Egypt [3], it may seem surprising that Alexandria suffered no more than the rest of Egypt during the outbreaks of 1931 and 1932. Cerebrospinal fever, as met with in Egypt, differs in no essential way from its appearance elsewhere. The seasonal incidence is winter and spring, the same as in the more temperate climate of Europe; and sporadic cases likewise keep turning up throughout the year, indicating that the disease never totally disappears between one epidemic period and the next.

This Alexandria study reviews, in terms of the humidity theory, data relating to the outbreaks of 1930-1931 and 1931-1932, and concerns mainly case-distribution and carrier-rates.

Kenawy [4] has made an interesting study of the distribution of cases over the various districts of the city for the epidemic period—November, 1931, to April, 1932. He has analysed 105 cases notified to the Sanitary Service, and finds that of the nine districts into which the city of Alexandria is divided, it is the Moharrem Bey district, sheltering a prosperous, comparatively easy type of inhabitant, which heads the case-list over the period, with 23 cases per 100,000 of its population. Gomrock, a working-class district, comes second on the list with 22 cases per 100,000, and the fashionable suburb of Ramleh third, with 19 cases per 100,000;

while Minet-el-Bassal and Karmous, inhabited by the very poor, figure actually at the bottom of the list, each with only 8 cases per 100,000. Can this peculiar case-distribution be accounted for on our humidity hypothesis? Unless it can, the hypothesis would stand greatly weakened.

The better-class district of Moharrem Bey is notably well wooded, and trees are known to constitute a cause of atmospheric humidity; besides it is in parts rather low-lying, and is widely traversed by the Mahmoudieh and Farkha Canals (fig. 2). It also houses the Alexandria Water Company's plant with its large "settling basins" and constant evaporation therefrom. It is further rich in many large gardens, which necessitate frequent watering. All these features tend to maintain a high outdoor humidity, with its repercussion on indoor humidity.

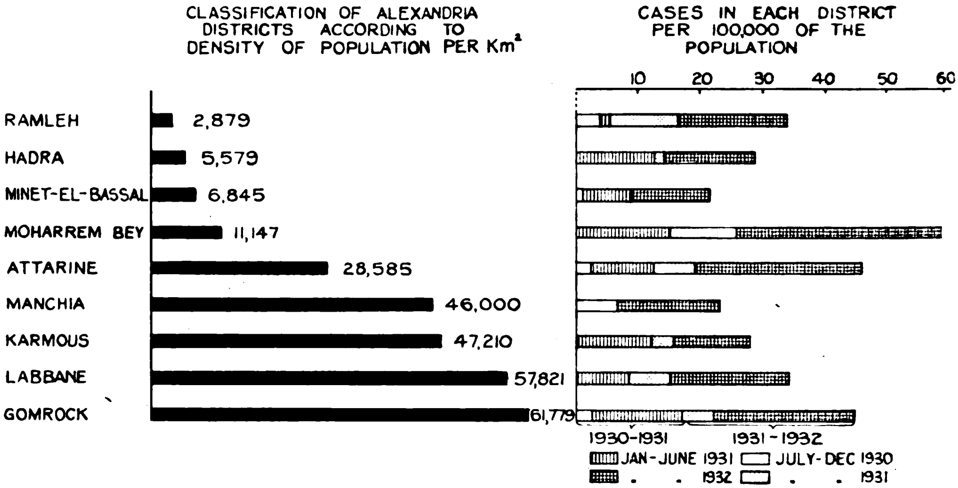

FIG. 1.—(1) Left: Giving an arrangement of the nine districts of Alexandria in terms of density of population per Km². (2) Right: Giving the case-distribution of cerebrospinal meningitis in the same nine districts over the two-year period 1930-1932.

Again, the Gomrock district, second on the case-list, is a more or less water-logged area, with damp subsoil, such that, as I am informed by our technical service, subsoil water can be tapped in parts at 60 cm. below the surface; besides it is bounded on three aspects by the sea. Further its density of population is the greatest of all the districts: 61·8 inhabitants per 1,000 square metres (fig. 1 (1)). It is not surprising then, that excessive outdoor and indoor humidities must characterize this area.

But what about the Karmous area, whose comparative indemnity from attack, on Kenawy's analysis, is so striking; and this in spite of its huge population (fig. 2), and the fact that it represents the poorest district of the city, where overcrowding must at times be very rife? It owes its comparative immunity, I think, largely to its geographical situation, being situated for the most part well above sea-level, with a dry subsoil. This

means drier outdoor air, and consequently better circulation between outdoor dry air and such indoor moist air, as results from overcrowding, i.e., freer ventilation in this district.

But six months represents a very short period, and the resulting conclusions may not be wholly exact. Accordingly I have re-investigated the question, collecting from the archives data relating to a two-years' period: July 1, 1930 to June 30, 1932. Some 232 cases are represented, and their distribution over the various districts in terms of 100,000 of the population has been worked out (figs. 1 and 2). The total case-incidence over the two years is seen (fig. 1 (2)) to follow very closely that worked out by Dr. Kenawy for the shorter period. Moharrem Bey again heads the list,

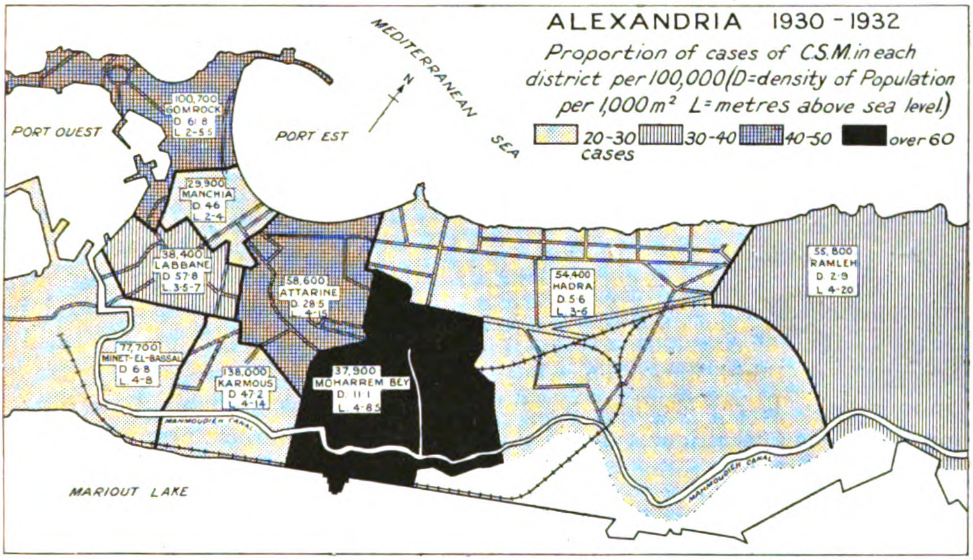

Fig. 2.—Showing the geographical situation of the nine districts of Alexandria, and their grading in terms of case-incidence of cerebrospinal meningitis over 1930-1932, together with information as to total population (1930), density of population and limits above sea-level of each district.

but Gomrock and Attarine now tie for second place, while Labbane ties with Ramleh for third place. Then come in descending order Karmous, Manchia and Minet-el-Bassal. Further, fig. 1 shows that there is no obvious connexion between density of population and case-incidence.

Attarine now steps into prominence. Why? No doubt because it adjoins the comparatively heavily infected Moharrem Bey area, with some overflow of contagion, which is better brought out by these studies over the longer period. That the district may have harboured a large proportion of "carriers" from the previous epidemic period seems to be indicated by fig. 1 (2). This figure indicates the cases of the respective districts distributed in terms of the four half-yearly periods during which they

occurred. The months January to June are considered epidemic months and July to December non-epidemic (or endemic) months. Attarine shows a fairly pronounced endemic period separating its epidemic periods.

It was primarily with the object of attempting to ascertain whether there was any district-immunity carried over from one epidemic season to the next that the distribution recorded in fig. 1 (2) was worked out. The figure establishes no such immunity; in fact the contrary is the rule; the districts most attacked in the epidemic months of 1931 were most attacked again in 1932. This is the outstanding lesson of the chart, and it is not encouraging for 1933, unless the non-epidemic months of 1932 should show a great falling off in sporadic cases. So far as the figure goes it seems to show no justification for the assumption that bacteriophage-immunity, in the sense conceived of by d'Herelle [5] for the "cholera carrier," plays any part in the story of "carriers" of meningococci. In this connexion I may add that I have worked hard to find a phage for the meningococcus, but hitherto without success.

The case of Manchia is of interest. Next to Minet-el-Bassal it shows the lowest total case-incidence. It escaped the epidemic and endemic periods of 1931 entirely, but it figures fairly prominently in the epidemic of 1932. Its geographical situation is bad, being low-lying and sandwiched between Gomrock and Attarine, both of which, over the two years' period, were attacked twice as severely. Its density of population is practically the same as that of Karmous, without possessing the favourable geographical situation of the latter. To what, then, does it owe its comparative immunity? To some extent possibly to the fact that Manchia represents on the whole a wealthier type of inhabitant than Gomrock, also with less overcrowding in the proportion of 46 : 62, or approximately 3 : 4 (fig. 1 (1)), with possibly a correspondingly lower carrier-rate. Its escape, however, seems to me to be accidental. It will be of some interest to see what happens in this district during the next epidemic season.

These observations, then, of Kenawy, and their extension, are of considerable interest. They afford on the whole a handsome confirmation of the humidity view, and one that we had every right to expect *ex hypothesi*.

Some general remarks on the climate of Alexandria in relation to outbreaks of the disease and our hypothesis seem called for. The city is characterized by a high humidity all the year round, but more so in the hot months of summer, which follows from its geographical situation, being surrounded by water on three aspects: on the north and west by the Mediterranean, and on the south by Lake Mariout (fig. 2). Yet the seasonal incidence of the disease is winter and spring, just as in Europe. The cause of the seasonal incidence cannot therefore be humidity, since the disease is for the most part represented by only sporadic cases during summer months. I think the seasonal variation is explained by the fact that many of the very poor sleep on the roofs of their dwellings during

summer, thereby bringing into play the protective factors of isolation and good ventilation, and are only driven to sleep indoors with the approach of winter when nights are cold and the rains arrive, conditions corresponding to the situation in Europe in winter and spring. Then overcrowding with high indoor humidity must exist. It follows that it is this driving indoors in winter of the carrier into overcrowded, badly ventilated dwellings which brings about, by contact, propagation of the carrier-state, and, by excessive indoor humidity, explosions of the disease.

Another protective factor in the situation as concerns Alexandria is that during the non-epidemic months of summer, and even during epidemic months, relatively few carriers are about. Throat-swabs from 857 contacts were sent to the Municipal Laboratories for examination during the epidemic period of 1931, and only six carriers were found, representing a carrier-rate of 0·7 per cent. During the non-epidemic months of 1931, 250 non-contacts, inhabitants of the Hadra Prison, were examined, and only one carrier was found (0·4 per cent). These carrier-rates may not be wholly exact, because practical difficulties intervened to prevent the determinations being ideal, notably as concerns the swabbing not being done personally, and the specimens being collected not on West's swabs but on ordinary slightly curved diphtheria swabs. While admittedly not perfect they nevertheless give, I think, a good approximation to the reality, especially when considered alongside an ideal determination carried out towards the close of the epidemic season of 1918 [6]. On that occasion 310 military non-contacts (from Mex and Mustapha Camps, and Nos. 19 and 21 General Hospitals) were swabbed and examined by Staff-Serjeant J. W. J. Leighton, B.Sc.(Lond.), R.A.M.C. (T.), and myself, working with West's nasopharyngeal swabs, pea-flour serum-agar medium from the then Central C. S. F. Laboratory, London, and a minimum of personal errors arising from the fact that both of us had had a long experience of such work in England. Only three carriers were found, representing a carrier-rate of one per cent, compared with a much higher rate among troops at the time in England.

Carrier-rates, then, on the whole would appear to be comparatively low in Alexandria, which is no doubt due to the sunshine and the out-of-door life of the place. It is well known that out-of-door life in the sunshine quickly clears up the throats of carriers of the meningococcus. I have frequently noted this fact in England [7]. Hence the probable explanation of why a city with such a humid climate as that of Alexandria escapes more serious infection.

To sum up, the foregoing facts concerning the disease at Alexandria harmonize perfectly with the view that outbreaks of cerebrospinal meningitis and their intensity are simply a function of carrier-rates and of atmospheric humidity, the latter acting most probably through an œdematous, spongy, diminished resistance state of the nasopharyngeal mucosa permitting penetration by the microbe [8]. Since the occurrence

of cases varies definitely with high carrier-rates and with raised atmospheric humidity, it is evident that when no carriers are about it matters not what the humidity conditions are, there can be no cases; and conversely, when there is no elevation of humidity it matters not how many carriers may be about there should be no cases. Thus we have "that intelligible whole which alone we call a picture or a view." And this, in a nut-shell, is the theory regarding the ætiology of cerebrospinal meningitis which I had the honour first to sponsor some seventeen years ago, and which I think still explains most of the facts of the disease.

Prophylaxis, then, should obviously aim at keeping indoor humidity as low as possible, by avoiding low-lying regions, particularly in the neighbourhood of trees, as the latter tend towards excessive outdoor humidity with repercussion on indoor humidity, when selecting sites for military camps, schools, and the housing of large numbers of individuals. Also, efficient drainage should be provided to eliminate subsoil moisture. In times of an epidemic, overcrowding, the drying of wet clothes in living quarters, and any other cause of excessive indoor humidity, should be scrupulously avoided. At all times good ventilation of sleeping apartments should be insisted upon, as this is the simplest means of combating excessive indoor humidity, which in conditions of overcrowding facilitates by contact the production of the carrier-state and by increased humidity the production therefrom of cases.

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OUR WOOLWICH MESS, 1882-1932.

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I.—Early Days, 1882-1890.

Many various causes are responsible for the fact that the minutiæ of the minor happenings of military domestic life are so quickly lost, and that the reconstruction of the picture of the daily life of an epoch, which has only just passed away, may be so difficult.

The Woolwich Mess is particularly fortunate in one respect concerning its history, for the original minute book recording the meeting which founded the mess has been in use for every subsequent meeting, and should serve the same purpose for a generous time to come, unless succeeding members become more prolix than their predecessors.

With this minute book as the basis the task of narrating the foundation and the vicissitudes of the mess over a period of fifty years becomes a fairly simple one.

The present time is appropriate for such a record as March 7, 1932, was the Jubilee anniversary of the establishment of the original Army Medical Department Mess at Woolwich in 1882.

The mess owed its origin to the dynamic personality of the late Surgeon-General Sir George Evatt, who was then a Surgeon-Major serving at the Royal Military Academy.

Surgeon-Major Evatt was then at the zenith of his activities, for it was in 1883 that he materially assisted in the early work which led to the formation of the Volunteer Medical Staff Corps, wrote a book, which went to three editions, on Army Medical Organization, and in the following year founded the Medical Officers of Schools Association.

His restless energy found a further outlet in 1886, when he was a parliamentary candidate in the Liberal interest for Woolwich, but success did not crown his efforts in that venture.

It was on March 7, 1882, that a meeting of the medical officers stationed in Woolwich was held at the Cadet Hospital of the Royal Military Academy to consider the formation of an Army Medical Department Officers' Mess at Woolwich.

The Army List for March of that year shows that there were eighteen medical officers in Woolwich, and of these sixteen were present at the meeting; doubtless duty, leave or casualties accounted for the remaining two.

Surgeon-General J. M. S. Fogo was in the chair; but, as he retired two months later, it may perhaps be legitimately deduced that he was not the leading spirit of the movement.

From various sources it would appear that a number of the more senior medical officers, who had been brought up in the regimental system, viewed with little favour the establishment of a purely medical mess. Surgeon-Major Evatt voiced the views of the more progressive party who were endeavouring to make the Medical Services a complete and corporate entity in the Army.

At this point it may be well to look at the military situation in Woolwich at the time in question. Woolwich ranked as a "District Command" under a Major-General directly subordinate to the Commander-in-Chief. The garrison consisted of an active brigade of Royal Horse Artillery, another of Field Artillery, and the large depot for training artillery recruits.

There was in addition a complete battalion of infantry (1st Battalion the Wiltshire Regiment) and a detachment of the Royal Warwickshire Regiment, whose battalion headquarters were at Warley.

(The guard duties at the Royal Arsenal were then performed by the infantry and absorbed a considerable number of dutymen daily.)

Two companies of the Commissariat and Transport Corps were also in the garrison; but the Army List only shows a total of six officers of the Commissariat and Transport staff, three of whom were quartermasters and one a "Temporary Captain and Deputy Assistant Commissary General on probation."

The medical establishments were the Herbert Hospital, completed in 1866 at a cost of £220,000, the Auxiliary Hospital (now the Medical Inspection Room) close to the Artillery and the Commissariat barracks, the Cadet Hospital at the Royal Military Academy, and the medical department of the Royal Arsenal.

The personnel consisted of eighteen officers of the Army Medical Department, with one Surgeon-General, one Brigade-Surgeon, eleven Surgeon-Majors and five Surgeons, which presents the same type of disparity between the normal relative proportion of ranks as that at present existing.

In addition there was an Apothecary (ranking as a Captain) whose dress the Army List states was scarlet uniform, grey cloth facings and edgings, "no pouch or belt."

A Captain of Orderlies of the Army Hospital Corps, of which No. VIII Division was quartered at the Herbert Hospital, completes the medical picture.

(It is interesting to note that the Army Hospital Corps officer at the Depot in Aldershot in 1882 is described as "Lieutenant of Orderlies and Instructor of Musketry.")

This then was the situation at Woolwich when the first meeting was held to consider the question of the formation of a "Meeting Place" for medical officers.

The first entry is to the effect that Surgeon-General Fogo requested Surgeon-Major Evatt to act as Secretary of the meeting.

The cart is very definitely put in front of the horse by the first two resolutions, which settle the rates of entrance contribution and monthly subscriptions before the question was raised as to whether the meeting should decide to form a mess or not.

The real problem was faced in the fourth resolution, which was "That the establishment be formed, independently of dining arrangements, as a convenient and comfortable place of meeting for Officers, Army Medical Department."

An amendment "That a Mess be started in Woolwich for the convenience of all Officers Army Medical Department" having been lost, the original resolution was carried by a majority of four votes.

Surgeon-General Fogo then proposed a nominated Committee of five under Brigade-Surgeon J. Wiles as President, with Surgeon-Major Evatt as Secretary and Treasurer, so selected as to give equal representation to the married and unmarried members, excluding the President.

It is rather curious at the present time to read the sixth resolution, "Whether the establishment be called Mess or Institute," and to learn that the designation of a mess was only gained by the narrow margin of two votes as a majority in the meeting of sixteen.

It would seem that there was a solid block of six medical officers who did not wish any "convenient and comfortable place of meeting" to be formed, if this voting is viewed in relation to the result of the voting on the fourth resolution quoted above.

The remaining voter against the use of the term "Mess" may have had in mind the Royal Artillery Institution at Woolwich or the Royal Engineers Institute at Chatham and have desired the "Meeting Place" to be conducted on similar lines.

The rest of the business at this meeting was of a purely domestic character relating to the collection and banking of subscriptions, the raising of a loan to purchase furniture and other matters of moment at the time, but of no particular interest now.

The next meeting was held a fortnight later, as the Director-General had intervened to point out that under the existing Queen's Regulations married officers could only be called on to pay half rates of the normal mess subscription.

The necessary resolution was passed to regularize the position. Surgeon-Major Evatt having been thanked for a gift of £25 to the mess, the meeting was dissolved.

Although there is no specific record it would seem that one of the factors which prompted the movement to establish the Army Medical Department Mess was that very suitable mess premises, centrally situated, were available owing to the paucity of officers in the Commissariat and Transport Staff having led to the closure of the old Commissariat Mess.

Furniture and fittings were purchased from this mess and a cheque for £55 14s. 6d. was despatched to "Assistant Commissary General Packyn" on May 30, 1882.

(This information is contained in the copy of a letter recorded in the minute book along with some nine other letters relating to mess affairs in 1882.)

Sanction was obtained for the Medical Officers' Library to be removed from the Herbert Hospital to the new mess, together with certain furniture therefrom.

A note of explanation might appropriately be made here of the history of the barracks then occupied by the Commissariat and Transport, and still in the hands of their lineal descendants, the Royal Army Service Corps.

The vast mass of barracks for the Royal Artillery was commenced in

FIG. 1.—Mess in Commissariat and Transport Barracks (1882-1890).

1776 and in co-relation with the scheme the necessary provision had to be made for the hospitalization of the inevitable sick.

The Royal Artillery Hospital (afterwards known as the Ordnance Hospital) was built in 1780 "on a plot approved by the Surgeon-General" between the Artillery Barracks and "Cholick Lane" (does the name of this by-way give rise to dark thoughts in the mind of the ultra-suspicious present-day hygienist?).

The hospital was designed for 200 patients, but on many occasions this number was greatly exceeded and the accommodation for the surplus patients was of a very primitive character.

The condemnation of the hospital after the Crimean War and the consequent erection of the Herbert Hospital in 1865-66 led to the premises becoming available as barracks.

It has not been possible to ascertain exactly what function of the original hospital existence was carried on in the rooms which subsequently became the mess premises; tradition, in this case, supported by grounds of reasonable probability, says the various mess rooms were the original Board Room and administrative offices of the hospital.

The exact date of the opening of the A.M.D. Mess is not recorded, but it would seem that Surgeon-Major Evatt could have wasted but little time as there is a copy of a letter sent to a wine merchant with a cheque for £5 in part payment of "your bill of 1st June, 1882, for wine, etc.," and an application on behalf of a Private of the Army Hospital Corps to return to his duty from employment as a waiter in the mess dated July 14.

At the next mess meeting, under the presidency of Brigade-Surgeon Young, it was decided by nine votes to three that the mess should not become a dining mess. The first meeting in 1883 shows that billiards was being played regularly; probably the table was included in the purchases from the old Commissariat Mess.

It is somewhat difficult to ascertain exactly when the Woolwich mess entered into its full function of becoming a normal dining mess.

In October, 1883, Deputy-Surgeon-General Sir James Hanbury "made some remarks as to what probability there was of having dinners at Mess, and asked if any estimate of the cost of equipment to carry out such a scheme was forthcoming." The Mess President was instructed to draw up the necessary estimate and forward it to the Principal Medical Officer for further consideration.

From a resolution passed in June, 1884, it may be justly inferred that a Dining Mess was established, as it is unlikely that a series of mess dinners, to the first of which all officers of importance in Woolwich were invited, would be proposed without further comment on ways and means, unless the mess itself provided the catering.

The resolution reads as follows : " That a Mess dinner should be given once a month to which all members would be able to invite guests . . . and that the next dinner be held at an early date next month, and that the General and Staff and Heads of Departments be asked as public guests."

In October, 1884, a resolution was passed that "£100 be raised to provide equipment to dine 36, and that provision should be made for a Sinking fund."

By Royal Warrant of September 20, 1884, the Army Medical Department became the Medical Staff, and the Army Hospital Corps the Medical Staff Corps.

Curiously enough the proceedings in the minute book referring to the two meetings held in 1885 refer to the "A.M.S. Mess," an abbreviation which was not legitimate until the formation of the Army Medical Staff under Army Order 187 of 1891. Internal evidence suggests that the wrongful use of the abbreviation was due to the clerk who copied out the proceedings : it is not repeated after 1885.

To those who regard an "Afternoon Dance" as a function of quite recent origin it will come as a surprise that a proposal to hold one and invite "The General and Staff, Heads of Departments, their wives and families" was carried in 1886.

In March, 1887, it was found necessary to make some stringent rules to enforce mess discipline to ensure "that the Mess should be maintained on a proper footing, and as it is found that this cannot be done unless the unmarried officers are regular dining members in the same manner as in a Regiment, and in accordance with the spirit of Section VII, para. 53, Queen's Regulations."

The resolution further states that "no dining member can be exempted from the charge for his dinner unless he has leave of absence with the sanction of the Principal Medical Officer, or as his individual case may seem to the P.M.O. to require."

The last rule to be adopted, which would appear to claim power beyond the scope of a mess meeting, reads ominously. "In the event of an unmarried officer not wishing to support the Mess as a regular dining member, his name will be submitted to the Director-General for such action as he may consider necessary." Perhaps it was only put in as a piece of bluff: there is no record that any such report was ever made.

In 1887 the first mention occurs of a regimental dance, when a resolution was carried that such an entertainment should be given by the mess "on a large scale."

In 1890 a new situation arose owing to the formation, by a Royal Warrant of December, 1888, of the Army Service Corps. By 1890 Woolwich had become the headquarters of seven Army Service Corps Companies, while a total of nineteen officers are shown in the Army List as serving at Woolwich, including those on probation, with a view to subsequent transfer to that Corps.

Not unnaturally the Army Service Corps were desirous of availing themselves of the mess premises situated in their cwn lines and only surrendered by the old Commissariat and Transport Staff owing to their meagre number of officers.

An unsuccessful attempt to obtain the return of the mess building had previously been made in 1887; but in 1890, when the Army Service Corps were very much to the fore, and the favourite of Fortune and the Horse Guards, the matter wore a very different aspect. Accordingly the mess premises were handed over to that Corps, and the Medical Staff Mess, before closing, arranged for the Library to be re-transferred to the Herbert Hospital and a reading-room to be refurnished therein.

Under Army Order 187 of 1891 the Army Medical Staff was formed and the new compound titles of Surgeon-Colonel, Surgeon-Captain and so on are first recorded in the meeting of medical officers held in the Officers' Library of the Herbert Hospital in September, 1891.

II.—Connaught House 1892-1899.

During 1892 various premises were considered as to their suitability for an Army Medical Staff Mess, and eventually No. 37 The Common (Connaught House) was selected. This house was fairly central for all the medical establishments, accessibility being a major consideration in those days, when neither buses nor trams were available in Woolwich ; the motor car was in its early infancy, and bicycles were in a primitive state of their development.

The premises were taken into use between January and October, 1893, and the virtual founder of the original Army Medical Department Mess,

Fig. 2.—Connaught House, 37, The Common (1892-1899).

G. J. H. Evatt, once again back in Woolwich, and now a Brigade-Surgeon Lieutenant-Colonel, was appropriately enough elected as P.M.C.

A glimpse is given of bygone domestic economics when the entry of a Mess Committee meeting is read: "Agreed to pay cook £30 per year, £5 to go towards payment of her lodgings." The Mess Sergeant only received £1 a month additional pay; subsequently another ten shillings was added to this.

No record exists of the actual number of dining members. The number of medical officers stationed at Woolwich remained fairly constantly just under twenty. At an important mess meeting about this time, when it is to be presumed as many members as possible would be present, the attendance was 17 (1 Surgeon-Colonel, 3 Brigade-Surgeon Lieutenant-

Colonels, 4 Surgeon-Majors, 8 Surgeon-Captains and 1 lone Surgeon-Lieutenant.)

The minute book is singularly devoid of interest for the first eighteen months. In April, 1895, there occurs the first entry of the Officers' Mess assisting in the recreation of the orderlies, when a resolution is recorded "that £5 be given to the Sports Fund of the 12th Company Medical Staff Corps."

The subject of afternoon dances was raised at the same meeting. Apparently the proposal met with little favour, as it was withdrawn, as also was a proposal for the holding of "Ladies Guest Nights."

Woolwich was not in the van of the movement leading to the present-day surrender to feminism.

It was also decided at this meeting that the Lincoln Regiment should be entertained at a guest night: this is the first note of any such regimental hospitality being extended to another unit as a whole.

A mess meeting was held in April, 1896, when trustees were appointed to a deed of assignment of all the mess property. It is difficult to understand at this date the object of the deed; certainly it caused the mess a good deal of legal expense later on, although the firm of Solicitors employed were lenient in scaling down their normal charges.

The Trustees appointed were Surgeon Major-General J. Jameson, Mr. V. G. M. Holt and Surgeon Lieutenant-Colonel W. C. Gasteen (retired).

It jumps to the eye, as the French say, that this arrangement was bound to cause a continued amount of legal expense in connection with the appointment of fresh trustees to replace casualties caused by death, age or unwillingness to continue the duties. That is the negative side; on the positive side it would seem that the interests of the mess and the security of its property could quite adequately have been left in the hands of the Senior Administrative Medical Officer and the Senior Executive Medical Officer. One clue to their appointment lies in the fact that one of the members of the Mess, besides being a Surgeon-Major was "of Lincoln's Inn, Barrister-at-Law," and that possibly he may have wished to make assurance doubly sure and to give the mess the benefit of his legal knowledge. (He actually drew up the trust deed.)

The trustees never seemed to have fulfilled any very necessary purpose, and it came as a real surprise to the mess meeting in 1924 that such trustees even existed. In the minutes of the January meeting of that year a letter was read from one of the trustees pointing out that as another one had died a further appointment was necessary. The minute states: "It was pointed out that the Mess Rules and K.R. contained no mention of the necessity for trustees, and the President asked for information on the matter. None being forthcoming. . . ." (two months later the whole matter was finally cleared up by Messrs. Holt and Co. taking over the permanent trusteeship of the mess for the very modest final settlement of five guineas).

It was about 1895 that the Woolwich Garden Parties in the grounds of the Herbert Hospital acquired more than local fame. The scene can be readily pictured from the descriptions by participants. The tennis courts were cleared of netting and tennis gear, and the Senior Officer and his wife received the guests towards the top of the lawns. Full formality of dress was *de rigueur*, at least for the visitors from London, frock coats, sponge bag trousers, as was the fashion for men at the time, with top hats, and long trailing skirts with pinched waists and leg-of-mutton sleeves for the ladies as depicted in the contemporary volumes of *Punch*. After the formal reception the guests and hosts solemnly promenaded around the grounds greeting and conversing with one another. The tennis lawns were occupied by this perambulation while the croquet lawn was given over to outdoor teas. Two or three side shows, an air-gun shooting gallery, a cockshy, a lady palmist and similar staid and elegant diversions were introduced in various years.

The Garden Party in 1896 must have been especially successful, for it led to the subsequent enactment of a scene of almost feudal solemnity at a full meeting of the members of the mess, which is recorded in the minutes in the following terms: "The P.M.O., having called in the Mess Steward, (Serjeant Noble, M.S.C.), informed him that the officers were much pleased with the efficient way in which he had arranged the refreshments at the Garden Party and the M.S.C. Sports."

A puzzling reference that "The air-guns and newspapers having been sold the meeting then adjourned" is explained by the fact that the air-guns were bought for the Garden Party and were not used, as the frivolous might suppose, to waken somnolent members or to hurry tarrying waiters.

An innovation was made in 1896 whereby the dining member was permitted to elect to pay for the mess dinner only, and for breakfast and luncheon as consumed, or to pay a flat rate of messing of four shillings a day. This is the same rate as that now in force with the advantage of the lower rate of ration allowance in favour of the present officer. As this is paid direct to the dining members they are financially some eighteen per cent better off than their predecessors in the Good Old Days.

A certain feeling of frustration is engendered at reading such ephemera as old mess minutes, as the continued history of an innovation is seldom recorded, and failures are too often "readjusted" to the former pre-innovation conditions without further written record.

It was first discovered in 1896 that a fly in the ointment in the matter of the mess premises existed, and a fly that caused a good deal of indignation and harassed feeling till the mess closed in 1899.

Although Connaught House had been appropriated as an Officers' Mess by Government, an undertaking appears to have been given, on behalf of the mess, that the members would be responsible to the landlord for repairs under the terms of the lease.

In 1896 the question of the exterior painting of the building was raised

and the subject was left in the hands of the P.M.O. to take up with the G.O.C. and C.R.E. Disappointingly enough no further reference occurs as to the solution of the difficulty.

A considerable amount of inco-ordination seemed to have arisen in the business dealings with the landlord during the whole period, as the mess minutes in 1899 aver that the "Barrack Department" failed to give notice to determine the lease at seven years, and that, in consequence, it was automatically extended to fourteen years.

As a few months previously members had been informed by the D.O.R.E. that the mess was responsible for all repairs it is not difficult to visualize the indignation displayed by a Special General Meeting on July 27, 1899, when a resolution was carried ". . . and why the Officers of the Royal Army Medical Corps were not consulted, and the reason of the lease being extended to fourteen years, when they had previously represented that Connaught House was quite unsuitable for their requirements as a Mess House." As will be seen later on in the narrative no record exists in the mess showing how the matter was finally adjusted.

The mess meeting held in May, 1898, was the last time the designation Army Medical Staff was used, as the Royal Warrant of 1898 constituting the Royal Army Medical Corps had been promulgated before the next meeting in October.

There is little to record in the last couple of years at Connaught House as only purely domestic matters are mentioned in the minutes until the final meeting on September 25, 1899, when a resolution was carried "That no future repairs should be carried out by the Mess."

The last resolution on record in the minute book shows a high fighting morale, although it remains with the jurist to say what validity or legality the spirited words convey.

"It was unanimously decided by the Members of the Mess that all and each one of them absolutely refuse any responsibility with regard to the repairs of the Mess, and that they consider themselves in no way responsible for the terms of the lease."

The actual formal closing of the Connaught House premises is not recorded, but it appears that the South African War in its earliest days so depleted the mess of Regular Officers that it was closed soon after the outbreak of hostilities.

III.—A Long Interlude, 1900-1909.

Of mess history there is nothing to relate until 1906, when a meeting was held at the Royal Herbert Hospital "to consider the question of re-establishing the R.A.M.C. Officers' Mess at Woolwich." That meeting also decided to re-open the Officers' Library in the Hospital and to fit it out as a sort of modified ante-room with newspapers, writing facilities and the like, and also to continue the tennis parties in the grounds of the Royal Herbert Hospital.

It should be remarked that it was in 1903 that the designation " Royal " was conferred on the Herbert Hospital. The May Army List of that year shows the plain designation, while the June number refers to the Royal Herbert Hospital as the name in use.

The Hospital joined a distinguished and very numerous company, for such a comparatively small garrison as Woolwich, to which the regal appellation has been accorded. This group includes the Royal Arsenal, the Royal Dockyard, the Royal Military Academy, the Royal Garrison Church and the Royal Military Repository, while even the former Veterinary Hospital is shown on the old maps as the Royal Horse Infirmary, and the garrison meteorological centre as the Royal Observatory.

FIG. 3.—Present Mess in Shooters Hill Road, opened 1910.

By February, 1909, the scheme for erecting a new mess building had advanced so far that a special mess sub-committee was appointed to represent the interests of the members during the construction period.

IV.—SHOOTERS HILL, 1910-1932.

The present mess building was commenced in 1909, completed in 1910 and opened as an R.A.M.C. Mess on July 1 of that year. The cost seems to have been very modest—£9,600 is shown on the official plans.

The site was very wisely chosen on the south-east edge of Woolwich Common, opposite the Royal Herbert Hospital in Shooters Hill Road. The building was erected to face a picturesque small copse and made roughly quadrant-shaped for this end.

The material used in the two-storied building was red brick with terra-cotta ornamentation. The mess contains twelve single officers' quarters, of which two are designed for Field Officers.

The mess room, which will dine nearly forty on a guest night, and

the other public rooms are adequate for their purpose. The present billiard room was originally designed for a library, but was saved for its present purpose by the activities of the special sub-committee mentioned before.

The fact that the mess was built well back from the road junction averted what would have been an almost intolerable affliction when the L.C.C. electric tramway system was extended and lines were laid from Woolwich to Eltham.

How small is human gratitude for wise and provident foresight is exemplified by the recording of complaints in 1911 that the members might be put to some expense on account of the picturesque copse which actually gave the form to the mess buildings, and which was disparagingly referred to as "The Jungle."

Once established, the mess settled down to normal routine and there is little that calls for comment. Two public-spirited officers erected the first motor garage in 1912 and agreed to hand it over to the mess when their estimated original outlay of £50 and expenses had been recouped. This did not take place till 1919.

The smouldering sparks of Sarajevo were alight, but did not burst into flame, on the last pre-war mess meeting at the end of July, 1914, when the question was taken up of constructing a tennis court in the mess grounds. Sterner business swept that project aside for nearly ten years.

During the Great War period little occurs of general interest. By May, 1915, the sum of £100 had been subscribed to the R.A.M.C. Prisoners of War and Comforts Funds—a very creditable amount.

The question of the mess privileges to be extended to Lady Doctors appears to have given rise to animated discussion. In July, 1917, the following resolution was passed, and, although subsequently challenged, was never rescinded : "That the privileges allowed to Lady Doctors, using the Mess, be limited to the use of the Card Room as a sitting-room in the afternoons, in addition to admission to the Dining Room for meals."

War-time rations and their allocation and the alleged depredations by civilian employees seemed to have affected war-strained nerves to bitter words in 1918; but the disputes were ephemeral and of little interest to the present-day reader.

More pleasing is it to record that in 1919 a proposal to make a presentation to the mess, on behalf of the Special Reserve, Territorial Force and Temporary Officers, led to the gift of a handsome massive silver bowl.

After the Great War period it seems to have taken the mess rather a long time to settle down and continue to expand its normal peace-time activities. However, a red hard tennis court was built in the mess grounds at a cost of £165 10s. in 1923, and a substantial new garage was built in 1925.

In 1927 the Central Mess Fund made a grant of £200 for laying down a hard tennis court in the grounds of the Royal Herbert Hospital, the necessary official authority for an encroachment having been obtained.

Woolwich came into line with some of the newer ideas by furnishing a ladies' room for tennis teas and so on in 1928.

And so this sketch of fifty interrupted years of mess history comes to an end. On the historical side the Woolwich Mess has no possessions of much interest. The oldest pieces of plate date back to the Medical Staff times (1884 to 1898). A large amount of the present silver was obtained after the Army Medical Staff was established in 1891. The sum of £100 was voted in 1895 to purchase suitable plate, and officers serving about that time were generous in their gifts.

In post-war times the "Whelan" Cup was presented by the local medical fraternity for team competition between the R.A.M.C. and the "Woolwich Medicals" at golf, and the mess reciprocated with a cup for individual competition. Both cups, the first time for several years, are now in the mess.

In conclusion it only remains to say that the title of the present narrative is misleading, but convenient. Administratively the Woolwich Mess is in the parish of Charlton in the Metropolitan Borough of Greenwich; the Royal Herbert Hospital, across the road, being in the Kidbrooke parish of the same borough.

Editorial.

THE STATE OF THE PUBLIC HEALTH.

In the February number of the Journal we dealt with certain sections of Sir George Newman's Report on the State of the Public Health; the present Editorial is concerned with other sections which we think will interest the officers of the Corps.

There was a decline in the number of cases of poliomyelitis and polio-encephalitis during 1931. Over a number of years there are great fluctuations in the prevalence of these diseases, but as little is known of the causative agent and means of spread it is difficult to institute preventive measures on rational lines. Early in 1932 Ebersen of the University of California reported the discovery of the causative organism, but his experiments have not yet been confirmed by work in England.

Kling and other observers have claimed that the disease may be conveyed by food or water. The contentions are based on certain observations made in the Bas Rhin Department, and in Sweden, Saxony, and Roumania and by experimental infection of monkeys by ingestion and the recovery of the virus from the fæces. It is considered that the disease is akin to enteric infections and that the virus is to be found in the fæces and probably in the urine in the acute stages of the disease.

During 1931 there was a greater prevalence of cerebrospinal fever in England than in any year since 1915. The chief prevalence was in the West Riding of Yorkshire. The Ministry's Report states that meningococci can be divided into two separate groups. Group I corresponds to the meningococcus of Dopter and contains Types 1 and 3 of Gordon. Group II corresponds to the parameningococcus of Dopter and includes Types 2 and 4 of Gordon. From March, 1931' to March, 1932, 465 strains, each from a separate case of cerebrospinal fever, were studied in the Ministry's Pathological Laboratory—of these 347 strains came from epidemic areas, such as the West Riding of Yorkshire, the others from non-epidemic areas, such as Manchester and London. The strains from the epidemic areas were found to belong to Group I, while those in the non-epidemic areas were classed in Group II. During the same period Topley and his collaborators isolated from the nasopharynx of about 20 per cent of normal persons in London meningococci which displayed serological affinities with Group II and not with Group I. It is stated that the best scheme for the serum treatment of a patient suffering from cerebrospinal fever at the present time is to give an adequate intrathecal dose of a serum prepared from Group I strains of meningococcus as soon as the diagnosis is reasonably clear on clinical grounds, as Group I is sufficiently prevalent nowadays to

make it likely to be the cause of the disease. When the type of the organism has been determined and if it is found to belong to Group II, then polyvalent serum should be substituted for Group I serum.

During 1931 there was a slight increase in the death-rate from pulmonary tuberculosis, probably due to a greater prevalence of influenza in the first quarter as compared with 1930, and to the less favourable conditions for respiratory diseases generally. There has, however, been a continued decline in mortality from non-respiratory tuberculosis. During the period covered by the decades 1891-1900 to 1921-30 the standardized rate for non-respiratory tuberculosis fell 63 per cent and the respiratory rate only 46 per cent. All non-pulmonary forms have shared in the decline, but this was most marked in tuberculosis of the intestines and peritoneum and greatest in infants and young children. A similar decline has occurred in most of the causes of infant mortality except broncho-pneumonia. A considerable share of the fall in the mortality from tuberculosis in childhood must therefore be attributed to non-specific causes such as better feeding, better housing and child welfare work. At the same time the risks of tubercular infection from human sources have been diminished by the removal of infectious patients from the home and by better provision for the disposal of infectious material. The risks of bovine tuberculosis have also diminished by the increasing use of breast-feeding and the pasteurization of milk.

Since 1924 the treatment of tuberculosis by a salt-free diet has been advocated in Germany. Gerson propounded the theory that in tuberculosis and some other diseases sodium chloride is retained in the body and the metabolism of acids and bases deviates from the normal. Hermannsdorfer adopted a modification of Gerson's diet in 1926. The Ministry considered that the dietetic treatment of tuberculosis should be investigated, and accordingly Dr. Pask, Medical Superintendent of the High Carley Sanatorium, Lancashire, visited Gerson's clinic in Cassel and Hermannsdorfer's clinics in Berlin. Dr. Pask did not recommend the adoption of either method of treatment, as he found no evidence that even if the diets were completely adopted there would be an appreciable improvement in the results of sanatorium treatment. A special kitchen is necessary; the diets cost thirty per cent more than the ordinary diets in a sanatorium; the diet is unpleasant and English patients would object to it.

The deaths from cancer continue to increase; during the period 1901-1905 the deaths per million in England and Wales from cancer were 867; in the period 1926-30 they were 1,411. It was pointed out in the report for 1930 that an increase might be expected, partly on account of the increasing number of old people and females in the population, and partly on account of the increasing ability to recognize the disease in the less accessible organs. A closer idea of the change in mortality may be obtained

if the effects of changes in the age and sex constitution are removed by standardization. Comparing the crude and the standardized mortality from cancer per million living at the quinquennial periods from 1901 to 1931, it is found that the percentage increase (persons) of the crude mortality is 76, and the standardized only 20; the crude male percentage increase is 110 and the standardized 40; the crude female percentage increase is 54 and the standardized 4·5.

The percentage increase for males is nine to ten times greater than that for females. An attempt to explain these differences is made by examining the standardized death-rates for individual organs as well as the percentage increases or decreases these display in the periods mentioned. Mortality may be looked upon as the outcome of incidence modified by diagnosis and treatment. When the diagnosis can be rarely at fault and treatment is of no avail the mortality will represent the incidence; but if the diagnosis presents no difficulty and treatment is effective the difference between mortality and incidence may be great. In the group containing cancer of the lip, tongue, jaws, pharynx, penis, scrotum and bones, little change is seen in the mortality. But in the case of cancer of the lung, intestine, gall-bladder, stomach, pancreas and rectum, marked percentage increases are seen. In these organs there has been a great improvement in precision of diagnosis, but the improvements in treatment have not been sufficient to affect the death-rate. Improvements in diagnosis should have the same effect in both sexes; yet the percentage increase of cancer of the lung is 294 in men and only 99 in women. Similar but mostly smaller differences are seen in cancer of the intestine, gall-bladder, stomach and rectum. Changes in incidence must have occurred in these organs affecting males more than females. Occupational risks may explain to a certain extent the difference in cancer of the lung in the sexes; but for other organs the explanation is not easily found.

Cancer of the liver shows a percentage decrease much the same in the sexes; this is probably due to better certification, secondary deposits in the liver being transferred to the organ primarily affected, such as the breast, intestine, etc.

In the case of the organs which show no marked change in the mortality rates it will be noticed that they are readily accessible. Cancer then is easy of diagnosis and comparatively amenable to treatment. Any increase in incidence would not be shown in the mortality rate, being kept in check by improved treatment.

It is evident that deductions as to causation which are based on a *total* mortality rate can have little value, since changes in the rate are compounded of stationary ratios for some organs, and increases and decreases for others.

An important point noticed is the remarkable constancy of the proportions which the various organs liable to be affected with cancer contribute to the total mortality.

The Report goes on to state that if the determining cause of cancer is a *general* factor it is difficult to understand why the overt effect of a general cause should be *particular* manifestations distributed in the same proportions year after year. If there is a general factor, the direction in which its effects will be manifested seems to be determined by particular local factors.

The crude annual death-rate from rheumatic fever in 1931 was 32 per million; less than half the rate (67) in 1901, and 10 per cent less than the previous lowest. While the deaths from acute rheumatism have been diminishing, there has been an apparent increase in crude mortality from heart disease. The Registrar-General points out that this increase is largely fictitious, being due to the increasing age of the population and the change in death certification, which makes more frequent record of degenerative changes in the heart-muscle than was customary a few years ago. Mortality from heart disease in the younger age-groups, in which rheumatism is the main factor, shows a considerable reduction.

It is pointed out that though the classic forms of acute rheumatism are disappearing, the insidious forms are still of importance. Attention to them by municipal authorities shows great variation and the fleeting opportunity to prevent organic disease which is now recognized as one of the major measures of preventive medicine may be lost. The great cities like London, Liverpool and Birmingham have shown how this problem can be tackled.

The London County Council's scheme of supervisory centres continues to extend. The history of 682 cases investigated from the day of onset to the age of 14 showed that children who develop acute rheumatism before 9 years of age are more likely to sustain a damaged heart than those in whom the rheumatic attack is delayed after this age.

The Rheumatism Scheme for Kensington, with its centre at the Princess Louise Hospital for Children, has continued its work under Dr. Fenton. No significant relation between dampness of houses, rat infestation or liability of the house site to flooding has been found, though there was marked correlation between the incidence of the disease and poverty with its accompanying overcrowding and bad housing.

An inquiry into the incidence of rheumatic heart disease in Gloucestershire, Somerset and Wiltshire has been carried out for three years. The most striking result has been the discovery that the incidence of rheumatic heart disease in Bristol is five or six times higher than in Gloucestershire and Wiltshire and three and a half times as high as in Somerset. That this is not merely an urban phenomenon is suggested by the low incidence in Bath and Swindon. Dr. Savage summing up the inquiry stated that the evidence adduced is against one environmental factor playing a significant part in the causation of rheumatic heart disease.

The Report states that the theory that infection of the throat with

hæmolytic streptococci has a causal relationship with acute rheumatism is gaining ground. Epidemic relapses of acute rheumatism in the rheumatic ward of the Cheyne Hospitals were found to follow throat infections with hæmolytic streptococci. Febrile affections not associated with hæmolytic streptococci did not cause relapses. Dr. Halls Dally, from observations on 250 children in the St. Marylebone Rheumatism Centre, states that "independently or not of the removal of the whole of the tonsillar tissue, rheumatism and its recrudescences have been observed in about 80 per cent of cases to follow a closely precedent nasal or pharyngeal inflammation."

A large number of patients (both control and rheumatic cases) have been tested by intradermal injection with hæmolytic streptococcal endotoxin elaborated by Dr. Griffith and Dr. Collis in 1931. Rheumatic patients are found to be more sensitive than the controls and those who have suffered from rheumatic symptoms during the six months previous to the test are found to be strongly positive. The value of this skin test is still *sub judice*, but it has been found to have a definite value in the diagnosis of streptococcal cases of erythema nodosum, and it is hoped that it may prove of assistance in the diagnosis of subacute rheumatism.

As an aid to the differentiation between active and non-active rheumatism the erythrocyte sedimentation rate has been found to be of value. Dr. Halls Dally at the St. Marylebone Centre notes that by means of the sedimentation velocity of the red corpuscles, 75 per cent of the presumed rheumatic children attending the Centre were found to present no focus of infection.

Dr. Gilbert Scott has shown that the earliest radiographic indications of arthritis may be seen in the bones of the hand irrespective of the existence of local symptoms. Under "standard" conditions the type of arthritis that may have attacked a major joint may be determined, although the X-ray examination of the joint itself often proves inconclusive.

In the section devoted to venereal diseases, reference is made to the investigations carried out by Dr. Clements and Dr. I. Oliver at St. Thomas's Hospital on the vaccine treatment of gonorrhœa. They have used a polar-body vaccine similar to that elaborated by Dimond at the Royal Herbert Hospital, and find that: (1) The use of a vaccine in the early stages of the disease is of doubtful value and may even be harmful; (2) administration of a good antigenic vaccine usually raises the titre of the complement-fixation reaction and coincidentally the gonococci disappear. If the strength of the complement-fixation reaction is increased substantially and the gonococci still persist, the cause can generally be found in a focus which has not been drained properly.

Dr. Wyler has elaborated a method of increasing the sensitiveness of the Wassermann test. He uses much larger amounts of the patient's serum and finds that while the specificity of the test is retained it is 20 per cent more sensitive.

Sir George Newman again draws attention to the two Memoranda furnished by the Special Committee on Nutrition. The Committee were satisfied by their inspection of Poor Law institutions that the quantity of food supplied was adequate, but they found three main faults: (1) A desire to keep cooking down to a minimum; (2) lack of knowledge of food values; (3) a tendency to monotony. These faults are unfortunately characteristic of many English dietaries. If the recommendations of the Committee are carried out there should be a great improvement in the diets of the people and many deficiencies should be made good.

In the Annual Report for 1928 the danger arising from the storage of food or drink in unsuitable vessels was pointed out. In recent years there have been several cases of poisoning in institutions, camps, etc., from the preparation or storage of food in vessels such as enamelled buckets and cans, or galvanized iron pails, which are particularly unsuited as the zinc coating may be dissolved by the food and produce sickness. In some of the cheaper grades of enamelled buckets and cans the enamel often contains a high proportion of antimony which may be attacked and dissolved by the weak acids often present in foods. Other cheap enamels may contain lead in a partially soluble form, and chronic lead poisoning may result from the use of utensils treated with this enamel. Persons in charge of institutions, children's holiday camps, canteens, etc., should take care that galvanized iron vessels are never employed for the preparation and storage of food, and in the case of enamelled ware only such vessels as are definitely intended for this purpose should be used. Cheap pails and buckets carry no guarantee that the enamel or coating is acid proof and will not dissolve in lemonade and similar acid drinks.

In connection with the fumigation of foods for the destruction of insect pests, reference is made to the control of the cocoa moth (*Ephestia elutella*), which is found in imported beans and appears to have become established in wharves and stores in this country. Experiments with HCN have not succeeded in completely destroying the moths with the strengths of gas and time of exposure adopted. The whole of the gas disappeared during the manufacture of the cocoa. The larger cocoa manufacturers maintain that fumigation is unnecessary to control the moth. They maintain that if proper care is taken in the handling and storage of cocoa the moth can be held in check.

Hydrogen cyanide is not recommended for the fumigation of dried fruit, which is often infested with *Plodia interpunctella* and other insects, as owing to the moisture content of the fruit considerable amounts of the gas may be retained in the fruit sugar.

It has been claimed that food can be preserved in good condition for many weeks by exposure to low concentrations (1 in 20,000) of hydrogen cyanide. The action apparently ceases when the food is removed from store.

For the fumigation of grain in bulk ethylene oxide mixed with carbon

dioxide is used in the United States. Solid carbon dioxide is now an article of commerce and when seven parts by weight are mixed with one part of ethylene oxide the gas is found to be non-inflammable.

A practice has arisen of polishing apples with a mixture of paraffin wax and a substance of higher melting point such as carnauba. The process gives the apples a better appearance and prolongs the life of the fruit and improves the prospect of marketing them in good condition. The amount of wax used is very small and does not conceal any inferiority, merely making the apples more pleasing to the eye. There does not seem to be any objection to the process on health grounds. The dyeing of oranges to improve their colour is a different question, as the process enables oranges which are of inferior quality or not ripe to appear of better quality, and Section 2 of the Food and Drugs Act of 1928 would apply to this practice.

Research work on malarial therapy has been carried on for some years at the Centre and Laboratory established at the Horton Hospital for the treatment of general paralysis of the insane by malarial infection contracted by the bites of mosquitoes. The new practice has made it possible to study the biological as well as the chemotherapeutic aspect of the subject.

Sir George Newman's Report states that quinine does not destroy the sporozoite stage of the malaria parasite; that it has a slight and uncertain action on the sexual stage, and that its curative effect is seldom permanent; that some species of the malaria parasite are more virulent to the human host than others; that there is a striking difference between the clinical virulence of different geographical races or strains of the same morphological species; that the tolerance which arises from repeated attacks of malaria is specific to the particular strain concerned.

We are informed that "as regards the common practice of taking a prophylactic dose of quinine daily, the manner in which this dose acts (by mitigating or suppressing the clinical symptoms rather than by preventing infection) has been ascertained and defined so clearly that there is no longer doubt or confusion on the matter, and no longer any reason for advocating or for condemning the practice in all circumstances, or for inability to define the conditions in which the practice should still be advised and the period over which the dose should be taken."

Koch, and later Grassi, believed that the best way of breaking the epidemiological chain was to destroy the parasite in the human host. This view has received support by the success which has attended the treatment of kala-azar and bilharziasis. We know that quinine and plasmoquine are selective in their action on the different stages of the parasite in the human host and the aim of chemotherapy should be not only to find a drug which would be more effective than quinine on the asexual stages of the parasite, but to find drugs which would be effective against the stage responsible for infection, and the stage responsible for

relapses. Experiments with this end in view have been carried out at Horton since 1927 as opportunity offered.

The scale on which experiments can be carried out on man is necessarily limited, so arrangements have been made at Elberfeld to experiment with birds infected in the natural way by the bites of mosquitoes, and by using birds infected with avian parasites of the "halteridium" type as well as birds infected with the "proteosoma" type. Similar arrangements are gradually being made in England and other countries and it is hoped that in this way antimalaria chemotherapy will be stimulated, and that "plasmoquine and atebrin are only first steps in the great march of progress for which their discovery has blazed the trail."

Plasmoquine is stated to be more effective as a true prophylactic than quinine, but unfortunately the dose required to ensure complete protection in a very malarious locality is one which can only be taken for a few days without risk of toxic symptoms. "For this reason the use of plasmoquine as a prophylactic has at present only a very limited application. It can be used in particular individual cases but not as a general method."

We hope to deal with the illuminating researches at Horton in a further communication.

Clinical and other Notes.

TWO MISLEADING CASES.

By Major G. MOULSON,
Royal Army Medical Corps.

Case 1.—Acute cholecystitis with cholelithiasis and partial perforation of the gall-bladder.

Pte. T., the Buffs, served 6 years. Aged 25.

Past History.—Since the age of 12, this patient declared that he had been troubled with indigestion. He enlisted at the age of 18, when it was recorded that he was 3 lb. under weight. During 4 years' service in India, he states that he frequently reported sick with pain in the epigastrium which was thought to be due to "gastritis."

His Medical History Sheet for that period showed two entries. August 3 to 9, 1928—seven days. Diagnosis "hæmatemesis." "Patient states he brought up half a pint of blood after something had stuck in his throat while eating his tea. History of indigestion up to age of 18. No recent indigestion. No further hæmatemesis or melæna while under observation. No evidence of gastric ulcer."

October 5 to 16. "Gastritis acute"—twelve days. "Epigastric pain and vomiting of bile-stained fluid. Tenderness in epigastrium near mid-line suggesting duodenal source. No hæmatemesis or melæna. According to the patient the pain was severe, used to recur a few minutes after food, and was relieved by taking preparations of bismuth. No history of enteric fever or other tropical disease could be elicited."

History of Present Illness.—Fourteen days before the patient was admitted to the Royal Herbert Hospital, he states that he was seized with very severe pain in the upper abdomen, lasting about ten minutes.

On February 3, 1932, the day of admission to hospital, Pte. T. stated that he woke up with a severe pain in the usual place. He ate nothing but two ounces of dry bread for breakfast, but by midday the pain had become worse. He arrived in hospital at 8.30 p.m. on transfer from the nearest reception station with a provisional diagnosis of "perforated duodenal ulcer."

On admission, the patient complained of very severe pain in the subcostal angle. Temperature 100·2° F. Pulse 100 per minute, but slowed to 80 within half an hour of admission. He was reported to have vomited previously.

When first seen by the writer about 9 p.m., the patient was lying on his left side with knees drawn up and obviously in great pain, which, he stated, was constant and continuous. The upper abdomen was very tender

and very rigid, but not absolutely "board-like." It was scarcely moving with respiration and the abdominal reflexes were absent. Liver dullness did not appear to be diminished and the point of maximum tenderness complained of appeared to be in the subcostal angle, in the mid-line. The history and the mid-line pain seemed to favour a diagnosis of a gastric lesion, while the position of the patient and the absence of true boarding and of diminished liver dullness seemed to negative the possibility of an acute perforation of a chronic ulcer into the general peritoneal cavity. Furthermore, the amount of shock present seemed inadequate for such a lesion subjected to a journey by ambulance.

A provisional diagnosis of an ulcer of the lesser curvature leaking into the lesser sac seemed to meet the case as well as any.

Operation was performed at 10.30 on the night of admission under open ether and warmed ether (Shipway) anæsthesia. The abdomen was opened through a right paramedian incision corresponding to the upper two-thirds of the right rectus muscle. On opening the peritoneum, no gas or fluid escaped. The appendix was sought for and removed though not obviously diseased. The pancreas appeared to be hard and the seat of some chronic inflammation. No ulcer could be seen or felt either on the stomach or duodenum.

On inspection, the gall-bladder appeared reddish in colour and there was an ovoid swelling projecting beneath the peritoneal surface of the fundus. The proximal half of the organ was partially obscured by old adhesions joining up to surrounding structures. On palpation, the projection on the surface of the fundus was found to be a stone and the whole gall-bladder was merely an inflamed sac surrounding a solid mass of calculi.

Cholecystectomy appeared to be the operation of choice as the condition of the organ was hopeless, while the general condition of the patient was good. Owing to the adhesions present the removal of the gall-bladder was effected from the fundus proximally, instead of in the reverse way more generally favoured in uncomplicated cases. The operation proved difficult as, owing to the friable condition of the gall-bladder wall, it ruptured during the manipulation necessary for its separation, and four or five stones with some bile were extravasated into the surrounding packs. Every possible care was taken to avoid injury to the hepatic and common bile-ducts by dividing the cystic duct at its point of junction with the neck of the gall-bladder, on the duct side of the last palpable calculus. The cystic duct and artery having been tied, a quarter-inch calibre split rubber drainage tube, containing gauze drain, was inserted down to the cut end of the cystic duct, the remainder of the abdominal incision being closed in layers. The operation lasted one and a quarter hours; the pulse-rate on return of the patient to bed was 100. Morph. ¼ grain was ordered, together with glucose saline per rectum four-hourly.

February 5, 1932: Forty-eight hours after the operation, the patient

appeared to have a post-operative collapse of the right lung. Breath sounds were hardly detected and a copious sputum was expectorated before relief ensued. Bile-stained discharge, via the drainage tube, was slight for the first twenty-four hours after operation, after which it ceased. February 7: The patient was noticeably jaundiced, bile being present in the urine and absent from the stools. February 8: Calomel 3 grains, followed by salts in the morning, produced a profuse discharge of bile via the wound, soaking the dressings and necessitating change of bed-clothes three or four times. February 9: Little discharge from wound this morning, chest clearing, jaundice fading, normal pulse-rate and temperature. The urine shows little or no bile. A stool passed last night was still very pale. Urotropin, 10 grains, prescribed in a mixture t.d.s. Taking fish, eggs and fluid well. February 10: The patient is much better. The flow of bile from the drainage tube has ceased. Normal motions and urine passed. February 12: Progress continues, stitches removed, wound healed except for drainage opening. February 16: Drainage tube removed yesterday. No discharge, wound nearly healed; taking chicken diet. Temperature and pulse-rate remain normal. February 18: Wound soundly healed. Patient allowed up. March 2: The patient has been getting up for an increasing period each day, and states that he has not felt so well for years. March 4: Discharged hospital on twenty-eight days leave.

Summary.

The interesting points in this case are:—

(1) The well-marked "gastric" history in a young man of 25 years of age dating back some years.

(2) The absence of positive findings on his two previous admissions to hospital. According to the man's own statement, he was frequently compelled to report sick and felt that he was regarded with suspicion of being a malingerer.

(3) The absence of any history of biliary colic, although the forty calculi in the gall-bladder varied in size from a pin's head to a hazel-nut.

(4) The confusion in diagnosis caused by the apparent mid-line pain and tenderness in the subcostal angle. Absence of diminished liver dullness, though usually detectable in cases of a perforated viscus, is not considered to be pathognomonic of such a condition. The position of the patient, when first seen by the writer, lying on his side rather than his back, was interesting, but not conclusive, since a patient after admission for a perforated duodenal ulcer will rarely adopt the lateral posture.

(5) The appearance, on opening the peritoneum, of a tumour situated on the fundus of the gall-bladder, eventually proved to be a stone in process of ulcerating through the wall of the viscus, which had arrived at and was only separated from the general peritoneal cavity by the thickness of the peritoneal coat. It is computed that only about ten cases of perforated

gall-bladder come to operation in every 1,000 cases of gall-bladder disease that undergo surgical treatment, so that operation on a patient in process of perforation must be a fairly rare occurrence.

(6) The dramatic crisis which complicated the immediate post-operative period and which would appear to have a simple mechanical explanation. In the first forty-eight hours after operation, the common bile-duct became blocked either by an overlooked calculus or by swelling of an inflamed mucosa aggravated by operative manipulations. Absence of biliary colic or of any great pain in this period points to the latter as the most likely explanation. A rising pressure in the cystic and hepatic ducts associated with marked jaundice evidently "blew" the ligature off the cut end of the cystic duct with immediate outpouring of bile and gradual disappearance of jaundice. Forty-eight hours later bile ceased flowing from the drainage tube and colour returned to the stools, evidently as the result of the patency of the common bile-duct becoming re-established. Since the cut end of the cystic duct was at this time patent, there can have been but a very small pressure in the common bile-duct. This supports the theory that the flow of bile along its normal course was more likely due to subsidence of inflammation in the common bile-duct mucosa, than to the onward passage of a calculus into the duodenum.

(7) The advantages of cholecystectomy over cholecystostomy in the presence of an inflamed gall-bladder where the general condition of the patient warrants the performance of the longer and more difficult operation.

(8) The dramatic and very temporary nature of the post-operative complications which so rapidly succeeded each other and which permitted of primary union in the wound except for the small hole made by the drainage tube, and allowed the patient to be discharged from hospital completely healed twenty-eight days after operation.

Report on Gall-bladder removed by Operation on February 3, 1932. By Major F. J. Hallinan, R.A.M.C.

The gall-bladder is 2½ inches long by approximately 1 inch in diameter, flesh-coloured in appearance, irregular in shape, its cavity being distended by a closely packed mass of stones.

At the lower extremity a stone is bulging through the wall, being covered only by peritoneum and a thin layer of tissue.

The wall of the gall-bladder is very thin and friable, and the mucosa is thin and scarred.

The cavity is distended by thirty-five faceted gall-stones, the largest being a half-inch pyramid and the smallest only one-eighth inch in size.

The stones are a pale-yellow colour, on section they are composed of a soft brown centre surrounded by yellow, brown and white lamellæ.

Chemical Composition of Gall-stones.—Mixed cholesterol and calcium bilirubin.

Bacteriological Examination.—A culture from the centre of the gall-stone was sterile.

Histological Examination.—A section was made through the wall at the lower end of gall-bladder; the wall is composed of loosely arranged connective tissue with a few strands of muscle fibres. The normal columnar epithelium lining the gall-bladder is only present in small patches, most of the epithelium having been replaced by organized granulation tissue in which are embedded clumps of alveolar glands lined by low columnar epithelium.

(*To be continued.*)

Echoes of the Past.

INSTRUCTIONS

TO

REGIMENTAL SURGEONS,

FOR REGULATING THE

CONCERNS OF THE SICK,

AND OF

The Hospital.

WITH AN APPENDIX.

(*Continued from p.* 149.)

REGULATIONS—*continued.*

Washing. The washing of bedding in Regimental Hospitals (out of Barracks) is part of the duty of the Nurse, unless her time be otherwise occupied by a heavy sick list. The personal washing of the sick is to be committed to the charge of some woman out of the Hospital; and to be paid for at a regular price, but the ordinary washing must in no case exceed 4d. per man per week, in the infantry, and 6d. in the cavalry. All extra washing must be specifically stated in the extra. table.

Medicines. When a Regiment has been furnished with one or more Medicine Chests (according to its strength) the subsequent

Supplies are to be drawn from the Public Elaboratory, by a requisition made to the Inspector General, half yearly, viz. on the 24th June, and 24th December.

An Invoice of the Medicine Chest now in use, is given in the Appendix, (No. 8), and the Surgeon is expected to confine his practice to it.

When a Medical Officer of a Regiment desires to use a Medicine not in his Chest, he must procure it at his own expence, unless in his Weekly Return, he can explain the peculiar necessity of the Case that called for it.

At the before-mentioned periods, viz. 24th June, and 24th December, the Surgeon will send Returns, stating the quantities last received, the present stock in hand, and a detail of the articles to be renewed; with the quantities that may in his judgment be equal to the probable wants of the ensuing six months, not exceeding the original Supply. It is very desirable that all intermediate requisitions be avoided, but if real and unexpected consumption should make it necessary, the extra supply must be drawn as before from the Public Elaboratory. No Druggist's charge will be admitted, unless the Surgeon has previous permission to purchase occasional articles; or unless the pressure of the moment will not allow of that delay: the circumstances with the charge must be then stated in the next Weekly Return.

Allowance of Medicines to Soldiers Wives and Children.

The Wives and Children of Soldiers are allowed Medicines from the Chest, but this indulgence is not to extend to any Charge on the Hospital Fund.

Regulated Allowance to Country Practitioners.

When a Detachment is without a Regimental Assistant, and is not within reach of any Military Surgeon, the country practitioners may be employed. The regulated allowance has been at 1d. per man, per week, for medicines and attendance; but, where the number is under Thirty, and the Contract cannot be made for that Sum, it is allowable to give 6d. per month. Every Officer commanding a Detachment, should be apprized by the Regimental Surgeon of this Regulation, and of the necessity of certifying in the Bill the precise number of men and the period of attendance; as, without this form, the Charge will be rejected. When from the pressure of the moment (on a march or on furlough) such agreements cannot be made, the country practitioner will be allowed to charge his Medicines at a price suited to such class of Patients.

When smaller numbers are under the command of a Serjeant, it should be his duty to have the Bills certified by the proper Officer of his Company as soon as he joins the Regiment.

Bills of Country Practitioners.

The Bills of Practitioners, and other Bills must be early sent for approval to the Inspector General; and when paid must be inserted in the next Weekly Return. A half yearly account is to be made up on the 24th June, and 24th December, according to the form in the Appendix, (No. 9.) and be transmitted to the Inspector General; which account must include all Expences of the period that have not been charged in the Weekly Return: It is to be certified by the Commanding Officer of the Regiment, and accompanied with regular Vouchers. All Charges or Bills in arrear beyond the half year, will be positively rejected.

Every Surgeon, before he quits his situation or leaves the kingdom, must make up his accounts from the last half yearly Settlement, and transmit the same to the Inspector General, or he will be charged by the Pay-master to the whole amount of the uncertified Expenditure.

The Surgeon is to deposit in the hands of the Pay-master, monthly, any growing surplus of the Hospital Fund, taking his Receipt for the same; and when Deficiencies shall call for an advance of money to the Surgeon for Hospital uses, the Paymaster, by a late Order from the War Office, is allowed to issue it on account, under the authority of the Commanding Officer.

Every Regimental Surgeon and Assistant Surgeon, on receiving the Commanding Officer's authority for so doing, are expected to take care of the sick of any other Regiment, Detachment or Recruiting party, Men on furlough, &c. whose Regiments are at a distance, provided there is no general Hospital in the neighbourhood.

Removal of Hospital Stores.

The removal of Hospital Stores is not a charge on the Hospital Fund; they are considered as part of the Regimental Baggage, and must be conveyed according to the War Office regulations.

Mode of Corresponding with the Army Medical Board.

All Letters and Returns to the Inspector General, or any other Member of the Army Medical Board, must be sent under cover to the Right Honourable the Secretary at War, War Office.

The foregoing Instructions are to be strictly observed by the Regimental Surgeon; all former Rules and Regulations being revoked.

L. PEPYS.
T. KEATE.
F. KNIGHT.

APPENDIX (No. I).

GENERAL ORDERS.

HORSE-GUARDS.
3d February, 1803.

THE Commander in Chief, has observed, that the benefit to be expected to the Service from the encreased Establishment of the Regimental Medical Staff Officers, has been in many Instances entirely lost by these Officers having been permitted to go on leave of Absence in common with other Officers of the Regiment, without a due attention to the particular nature of their Employment, and to the importance and necessity of their constant attendance; nor has the expence to the Public, for the extra Attendance or Country Practitioners been diminished in the Proportion, which might have been expected, from the encreased Medical Aid, which has been afforded to Regiments

His Royal Highness recommends these Observations to the serious Consideration of Officers, in the Command of Regiments, and enjoins them to be very circumspect, in the Leaves of Absence, which they hereafter recommend for their Regimental Surgeon and Assistant Surgeon; the Applications can be proper only in one of the following Instances, either that from the Regiment being assembled in one or two Quarters, and remarkably healthy, the Attendance of one of the Medical Staff Officers can for a time be dispensed with; or else, that from particular Circumstances the Indulgence of Leave of Absence to an Officer of this description, becomes an object of most material Importance to his private Concerns.

Officers Commanding Detachments, not having any Medical Staff Officer attached to them, are immediately on arrival at their Stations, to enquire whether there are any means of obtaining Medical Assistance from a Military Staff Officer in the Vicinity, and it is only in cases when such Aid cannot be obtained, that they are justified in having recourse to the Practitioners of the Country, of which a special Report is immediately to be made to the Officer Commanding the Regiment, who will state the same to the Inspector General of Regimental Hospitals; hereafter, no charge will be admitted for extra Expences incurred for Medical Assistance, the Necessity of which has not at the time, been reported in the manner above directed.

By Order of His Royal Highness
The Commander in Chief,
HARRY CALVERT,
Adjt. Gen. of the Forces.

APPENDIX (No. II).

LIST OF ARTICLES

TO BE FURNISHED BY THE

BARRACK DEPARTMENT, FOR THE USE OF REGIMENTAL HOSPITALS IN BARRACKS.

KITCHEN.	SURGERY.	WARDS.
A set of Fire-Irons	Fire Irons	Bedsteads
Fender	Fender	Palliasses
Trivet	2 Chairs	Pillows
Table	Forms	Bolsters
Dresser	Coal Box	Blankets
Small Forms, 2	Candlestick	Sheets
Shelves	Round Towel	Rugs
An Iron Pot, Pot-lid, and Hooks	Cupboard or Shelves	Chamber Pots
Wooden Ladle	A Tin Slipper Bath	Table
Flesh Fork		Small Forms
Bowls or Platters		Coal Box, small
Small Ditto, or Porringers		Fire Irons, viz. { Poker, Shovel, Fender }
Trenchers		
Spoons		
Coal Box		Candlesticks or Lamp
Candlestick		Round Towel
Tin Can		1 Close-stool for each Ward
Earthen Pan		
Box, or Basket, for carrying Coals in the Wards		2 Bed-pans for the Hospital
Buckets, Mops, and scrubbing Brushes	} Sufficient for the Use of the Hospital in General	2 Urinals ditto
Birch and Hair Brooms		
Round Towel		
1 Lanthorn		
2 Saucepans		
2 Large Tea-kettles		
Quart and Pint Pots		

APPENDIX (No. III).

A Compleat Set of Instruments, with the Modern Improvements, for REGIMENTAL HOSPITALS.

An Amputating Saw, with spare Blade
1 Metacarpal Saw, with ditto
24 Curved Needles
2 Amputating Knives
1 Catlin
2 Tenaculums
1 Bullet Forceps
1 Pair of Bone Nippers
2 Screw Tourniquets
4 Field Tourniquets with Handle
2 Callico Compresses

2 Trephines, with sliding Keys
1 Trephine Forceps
1 Elevator
1 Lenticular
A Brush
Key Instruments for Teeth, to fit Trephine Handle
8 Scalpels
3 Silver Catheters
2 Elastic Catheters
1 Trocar with Spring and introductory Canula
1 Ditto, ditto, and Canula for Hydrocele
1 Probang
1 Long Silver Probe

APPENDIX (No. IV).

Canteens of Hospital Utensils for 250 Men.

1 Flesh Fork
2 Iron Block Tin Soup Ladles
12 Trenchers
12 Iron Spoons
2 Tin Saucepans, 1 of 4 Qts. and 1 of 3 Qts. to shut in each other
12 Tin Cups of 1 Pint each
1 Horn Lanthorn
1 Iron Tea Kettle, 7 Quarts
1 Tea Pot, 5 Pints
2 Tin Candle Sticks, with Snuffers chained
1 Pewter Bed Pan
1 Pewter Urinal
6 Knives and Forks
1 Pair of Steelyards
2 Pint Tin Pots, with Handles
12 Cotton Night Caps
3 Yards of Osnaburgh
3 Round Towels
2 Rollers and 2 Pair of Brackets
3 Yards of Flannel
1 Hand Scrubbing Brush
1 Whitewashing Brush
2 Sponges
2 Large Wooden Platters
2 Pewter Wash-hand Basons
1 Tinder Box and Steel
2 Packing Needles
1 Trivet
1 Pair of Wooden Scales and Weights, 2oz. to 2lb.

Separate.

1 Water Bucket
1 Close Stool Bucket, with Pan
1 Iron Kettle of 6 Gallons

Articles to be purchased by the Surgeon.

1 Long Scrubbing Brush, with heavy block leaded
1 Hair Broom
1 Rag Mop
8 Earthen Chamber Pots

APPENDIX (No. V).

INSTRUCTIONS FOR VACCINE INOCULATION.

LET the vaccine fluid be taken, for the purpose of Inoculation, from a pustule that is making its progress regularly, and which possesses the true vaccine character, on any day from the fifth to the eighth, or even a day or two later, provided the efflorescence be not then formed around it. When the efflorescence is formed, it is always most prudent to desist from taking any more of the virus from that pustule.

To obtain the virus, let the edges of the pustule be gently punctured with a lancet in several points. It will gradually ooze out, and should be inserted upon the arm about midway between the shoulder and the elbow, either by means of a very slight scratch, not exceeding the eighth part of an inch, or a very small oblique puncture.

A little red spot will appear on the punctured part on the third day, if the operation succeed, which on the fourth or fifth becomes perceptibly vesicated. It goes on increasing till the tenth day, when it is generally surrounded by a rose coloured efflorescence, which remains nearly stationary for a day or two. The efflorescence then fades away, and the pustule is gradually converted into a hard glossy scab, of a dark mahogany colour. These progressive stages of the pustule are commonly completed in sixteen or seventeen days.

A single pustule is sufficient to secure the constitution from the small-pox; but as we are not always certain the puncture may take effect, it will be prudent to inoculate in both arms, or to make two punctures in the same arm, about an inch and a half asunder, except in very early infancy, when there is a great susceptibility of local irritation.

If the efflorescence surrounding the pustule should be extensive, and occasion much local heat upon the arm, it may be cooled by the repeated application of pieces of folded linen dipped in cold water; or still more expeditiously by a strong solution of the *aqua lythargyri acetati* * in water; an ounce, for example, of the former in five or six of the latter.

If the scab should at any time be prematurely rubbed off, and not succeeded by another within twenty-four hours, the part may be occasionally touched with the undiluted *aqua lythargyri acetati.*

Vaccine virus, taken from a pustule, and inserted immediately in its fluid state, is preferable to that which has been previously dried; but as it is not always practicable to obtain it in this state, we are compelled to seek for some mode of preserving it. Various means have been suggested, but from the test of long experience, it may be asserted, that preserving it between two plates of glass is the most eligible. Let a piece of common window glass be cut into squares of about an inch each, so that they shall lie smooth when placed upon each other. Let the collected vaccine fluid be confined to a small spot (about the size of a split pea) upon the centre of one of these glasses; which should be suffered to dry in the common heat of the atmosphere, without exposure to the heat of fire or the sun. When dry, it should be immediately secured by placing over it the other piece of glass. Nothing more is necessary for its preservation than wrapping it in clean writing paper.

The virus, thus preserved, when wanted for the purpose of Inoculation may easily be restored to its fluid state by dissolving it in a small portion of cold water, taken up on the point of a lancet. It may then be used in the same manner as when just taken from a pustule.

The vaccine fluid is liable, from causes apparently trifling, to undergo a decomposition. In this state it sometimes produces what has been denominated the spurious pustule; that is, a pustule, or an appearance on the arm not possessing the characteristic marks of the genuine pustule. Anomalies, assuming different forms, may be excited, according to the qualities of the virus applied, or the state of the person inoculated; but by far the most frequent variety, or deviation from the perfect pustule, is that which arrives at maturity, and finishes its progress much within the time limited by the true. Its commencement is marked by a troublesome itching: and it throws out a premature efflorescence, sometimes extensive, but seldom circumscribed, or of so vivid a tint as that which surrounds the pustule completely organized; and (which is more characteristic of its degeneracy than the other symptoms) it appears more like a common festering produced by a thorn, or any

* Goulard's extract of Saturn.

other small extraneous body sticking in the skin, than a pustule excited by the vaccine virus. It is generally of a straw colour; and when punctured, instead of that colourless, transparent fluid of the perfect pustule, its contents are found to be opaque. That deviation from the common character of the pustule, arising from vaccine virus which has been previously exposed to a degree of heat capable of decomposing it, is very different. In this instance, it begins with a creeping scab, of a pale brown or amber colour; making a long and slow progress, and sometimes going through its course without any perceptible efflorescence. Its edges are commonly elevated, and afford, on being punctured, a limpid fluid.

A little practice in vaccine Inoculation, attentively conducted, impresses on the mind the perfect character of the vaccine pustule; therefore when a deviation arises, of whatever kind it may be, common prudence points out the necessity of re-inoculation, first, with vaccine virus of the most active kind, and secondly, should this be ineffectual, with variolous virus. But if the constitution shews an insusceptibility of one, it commonly does of the other.

When any constitutional symptoms occur in inoculated Cow-pox, they are commonly first perceptible (especially in children) on the fourth or fifth day. They appear again, and sometimes in adults, not unlike a mild attack from inoculated small-pox, on the eighth, ninth, or tenth day. The former arise from the general effects of the virus on the habit, the latter from the irritation of the pustule.

If the effluvia of the small-pox have been received into the habit previously to the inoculation of the vaccine virus, the vaccine inoculation will not always be found to stop its progress although the pustule may make its advances without interruption.

The lancet used for inoculation should always be perfectly clean. After each puncture, it is proper to dip it into water, and wipe it dry. The Practitioner should be particularly cautious in observing tbat its point be free from rust, either contracted by common means, or from the action of the vaccine virus; which, even when dry and in contact with it, has a tendency, in a little time, to produce it; therefore the preservation of vaccine virus upon a lancet, beyond the period of a few days, should never be attempted.

EDWARD JENNER.

APPENDIX (No. VI).

GENERAL ORDERS.

HORSE-GUARDS,
31st August, 1802.

THE Regulation for improving Regimental Hospitals, bearing date in the month of September, 1799, having directed that the sum of 4s. per week should be retained out of the pay of the Soldier, for his maintenance while in the Regimental Hospital, and for the incidental expences of the said Hospital; and it being thought proper to establish a new Rate of Stoppage applicable to the above purposes, and to the other purpose hereafter mentioned.—It is His Majesty's pleasure, that, from the 25th September next inclusive, the sum of 10d. a day shall be retained by the Pay-Master, or Acting Pay-Master, out of the Pay and Beer-money of each Non-commissioned Officer, Trumpeter, Drummer, and Private Man of His Majesty's Regiments of every description, during the time of their being in the Regimental Hospital; and that the same be paid over to the Regimental-Surgeon, as a Fund, to be applied by him, under the superintendence of the Commanding Officer, to the maintenance of the men, and the general Expences of the Hospital.

It is His Majesty's further order, that regular Accompts of the expenditure for the above Services, to be kept by the Regimental Surgeons of the Regiments of Cavalry and Infantry of the Line, to be furnished by them (being previously certified by the Commanding Officer) to the Inspector-General of Army-Hospitals, at such times and in such forms as shall be prescribed through the said Inspector-General, in order that, in the case of a deficiency of the said Fund, the same may be made good; and that, in the case of a Surplus, the same may be applied to the general Medical Expences of the Corps.

By Order of His Royal Highness
The Commander in Chief,
HARRY CALVERT,
Adjutant-General.

APPENDIX (No. VII).

DIET TABLE.

Meals	Full	Half	Low	Spoon or Fever Diet	REMARKS
Breakfast	1 Pint of Milk Porridge or Rice Gruel	1 Pint of Milk Porridge or Rice Gruel	1 Pint of Milk Porridge or Rice Gruel	Tea	All Extra Diet to be given at the Discretion of the Surgeon, but it must be stated and charged in the proper Table of the Weekly Return, against the respective Patients Name whose Situation demands it. Wine used in Panado, Sago, or in any kind of Food must be similarly specified in the Wine Return.
Dinner	$\frac{3}{4}$ Pound of Meat 1 Pound of Bread 1 Pound Potatoes	$\frac{1}{2}$ Pound of Meat $\frac{1}{2}$ Pound of Potatoes 1 Pound of Bread	$\frac{1}{4}$ Pound of Meat, or made into weak broth $\frac{1}{2}$ Pound of Bread $\frac{1}{2}$ Pound of Potatoes	$\frac{1}{4}$ Pound of Bread made into Panado or Pudding with as much Milk; or Sago	
Supper	1 Pint of Broth made from the Meat		1 Pint of Milk Porridge or Rice Gruel	Tea	

N.B. The Allowance of 1d. for Beer Money will be admitted to any Patients, where the Surgeon may think it proper to grant Beer.

☞ The Milk Porridge is supposed to consist of Three Parts Gruel, with One Part Milk—The Spoon Diet is adapted to Fevers, and such Cases as will not allow of any Excitement from Animal Food, in the shape of Broth or otherwise.

APPENDIX (No. VIII).

INVOICE OF A REGIMENTAL CHEST OF MEDICINES, &c.

	Lib.	Unc.
Acid: vitriolic:		4
Ærug: Æris pulv:		2
Alumin	1	
Ammon: ppt:		8
Antimon: tartarisat:		2
Aq: Lytharg: acetat:		8
Argent: nitrat:		1
Balsam: Copaiv:	1	
Calomel: ppt:		8
Camphor:		8
Cerat: Lap: calaminar:	7	
——— Sapon:	1	
Ceruss: acetat:	2	
Confect: opiat:		8
Conserv: Rosæ		8
Cort: Peruv: opt: pulv:	7	
Cremor: Tartar: pulv:	1	
Cretæ ppt:		8
Empl: Cantharid:	2	
——— Lythargyr: c̄ Refin:	3	
Extr: Colocynth: comp:		8
Ferr: vitriolat:		4
Flor: Chamom: pulv:		4
—— Sulphuris loti		8
Fol: Sennæ		8
Gum: Ammoniac:		8
—— Arabic:	1	
————— pulv:		8
——Guaiac: pulv:		2
Hydrarg, muriat:		3
——— nitrat: rub:		4
Kali acetat:	1	
—— ppt:		8
—— pur:		2
Liniment: Sapon: comp:	1	
Liquor: vol: C: C:		8
Magnes: alb:		8
Natri vitriolat:	15	
Nitri purificat:	1	
Ol: Menth: piper:		1
— Olivæ opt:	1	
— Ricini — a Bottle.		
— Terebinthin:		8
Opii purificat:		4
Pilul: Hydrarg:	2	
Pulv: antimonial:		4
—— aromatic:		8
—— Digital:		4
—— Ipecac: comp.		4
Pulv: Rad: Ipecac:		8
———— Jalap:		8
———— Rhabarb:		4
———— Scill:		1
———— Zingiber:		4
Quass: abras:		8
Spir: Vini rectificat:	2	

	Lib.	Unc
Succ: Inspissat: Cicutæ		2
Tinct: Opii		8
Ung: Ceræ	3	
—— Hydrarg: fort:	10	
————— nitrat:		8
—— Psoric:	10	
Zinc: vitriolat:		4
Dr. James's Powder		1

APPENDIX (No. IX).

MATERIALS.

Fine Lint	Lib: 2
Surgeon's Tow	Lib: 5
Linen	2 Sheets
Skins of Leather	2
Linen Rollers	12
Flannel Rollers	6
Eighteen-tailed Bandages	4
Bag Trusses	6
Bougies in a Case	2 Dozen.
Tape	1 Piece.
Thread for Ligatures	1 Ounce.
Pins	2 Papers.
Grain Scales and Weights	1 Set.
Ounce ditto and ditto	1 Set.
Vials in Sorts	3 dozen.
Gallipots in ditto	2 dozen.
A Graduated Glass Measure.	
Writing Paper	3 Quires.
Wrapping Paper	3 Quires.
Pens	25
Ink Powder	1 Paper.
Wafers	2 Ounces.
A Bolus Tile.	
A Mortar and Pestle.	
Pill Boxes	3 Papers.
Urethra Syringe	6
A Glyster Syringe and Pipes.	
A Pewter bleeding Porringer.	
Bolus Knives	2
A Spreading Spatula.	
A Pot Spatula.	
A Tin Panakin.	
A Tin Funnel.	
Packthread	4 Ounces.
Surgeon's Sponges	6
Vial Corks	1 Gross.
Horn Cups	3
Common Splints	1 Set.

APPENDIX (No. IX).

Hospital Contingent Account of the Regiment of
from the 25th Day of to the
24th Day of 180

No. of Vouchers		£	s.	d.
	£.			

The above to the best of my knowledge is correct

C. D. Commanding Officer.

I certify the above to be a true Account.

A. B. Surgeon.

Current Literature.

M. E. F. Crawford, E. O. V. Perry and S. S. Zilva. **Vitamin Content of Australian, New Zealand and English Butters.** Medical Research Council, Special Report Series, No. 175.

The authors state that butters consumed in this country being of many origins and prepared under different conditions suggested the necessity of investigating the influence of the various factors connected with their manufacture, transit and distribution on their vitamin content.

In England the dietetic property of butter assumes special importance in the winter, when the amount of fat-soluble vitamins, especially D, consumed in the general diet may fall short of the minimum requirements. The consumption of a potent butter may make such diet adequate in this respect.

It was considered that the methods suitable for an investigation of this character should be biological. Vitamin A was estimated by the growth of rats kept on a diet free from vitamin A, but containing vitamin D. The test doses of the butter were given at a stage when the bodily reserves of vitamin A showed signs of depletion.

Vitamin D was estimated by the degree of calcification in the bone, determined by the ash content, of rats receiving a basal diet low in anti-rachitic vitamin and in phosphorus.

The authors consider that their observations, together with the results of isolated tests made by others, leave no doubt that the Australian and New Zealand butters when they reach the consumer in this country contain both vitamin A and vitamin D to a value as high as that of butters produced in Great Britain or elsewhere in Europe. The Australian and New Zealand butters do not fall short of the best summer butters produced here, or even of butters from cows whose diets have been fortified by an artificial supply of vitamin A and vitamin D. The methods of production, handling and the delay in transit have a negligible influence upon the vitamin content of the butters as they reach the consumer. This good and uniform potency of the Australian and New Zealand butters makes them a valuable source of the vitamins A and D for the British population, and especially during the winter season when the vitamin potency of home or other European butters may be low.

The stability of the vitamins of New Zealand and Australian butters during cold-storage is remarkable, and no fear need be entertained that they will diminish during the two or three months which usually elapse between the first preparation of the butters and their final consumption by this country.

"The Training of Medical Units in Gas Warfare." By Lieut.-Colonel G. L. McKinney, M.C., U.S. Army. *Military Surgeon*, 1933, lxxii, 1.

This article describes in detail a proposed scheme of training in chemical warfare protection and the primary treatment of gas casualties for a newly mobilized division; the training being based on the teaching given in the field officers' course at the Chemical Warfare School.

The Chemical Warfare School of the American Army is situated at Edgewood Arsenal, Maryland. Personnel from the Navy, Army and Marine Corps attend this School, and when they pass out, as graduates, are able to conduct the chemical warfare training of units and organizations. Since the establishment of the School in 1921, 1,335 officers and 318 enlisted men have so graduated, nearly half of the total number coming from the Navy.

The scheme of training described in this article covers a period of twelve weeks and is so arranged that the men are actually taught by their own officers and N.C.O.'s. It is assumed that on mobilization every divisional unit (including the medical regiment) will have a trained graduate of the Chemical Warfare School as its gas officer, and that he will have

at least two trained N.C.O. assistants. In the first fortnight of the twelve-week training period this gas officer and his assistants go to the Chemical Warfare School for a short intensive refresher course so, as a consequence, during this period the rest of the unit do no gas training, their time being fully taken up with other work. During the third, fourth and fifth weeks the regimental gas officer having done his course, now instructs the officers and N.C.O.'s of the unit. From the fifth to the tenth week, the officers and N.C.O.'s teach their own men. The last two weeks are to be occupied in combined divisional gas exercises. In this way the latest information from the Chemical Warfare School should be quickly spread through the whole division. The actual gas training is to be done by short lectures and demonstrations. Films will be used for the teaching as much as possible and great attention will be paid to actual practical work in the field, demonstrations being followed by the practical application of the subject. Medical units and detachments, in addition to the routine gas protection training, will be specially instructed in technical medical subjects, such as gas proofing of aid stations, de-gassing, handling contaminated clothing and in the diagnosis, care and first-aid treatment of gas casualties including the use of the necessary materials and equipment. The article ends with detailed syllabuses for the training of unit instructors and of the men, and in a special annex there is a short description of a motorized bathing plant to be used to form a de-gassing station in the field. With this plant 24 men can be bathed per minute, and it will carry sufficient water to bathe 700 men. Five hundred changes of uniform clothing are carried, arranged in four sizes, 500 towels and a special tent and shower-bath arrangement.

A. C. H. G.

DUDLEY, S. F. **The Relative Value of Some Diphtheria Prophylactics; and the Principles of Active Immunization against Diphtheria.** *Quarterly J. Med.* 1932, New Ser. v. 1, 213-32, 1 curve. [19 refs.]

The comparative immunizing value of toxoid and toxoid antitoxin floccules (T.A.F.) was determined at the Greenwich Hospital School. At the end of three months undiluted toxoid and T.A.F. gave equally good results, 97 per cent of the boys to whom they were given being rendered immune. The author stresses the importance of only relying on comparative tests carried out on populations, the herd-immunity of which to diphtheria has been thoroughly studied. A discussion is given of the problem of children who are refractory to immunization. The most refractory subject met with was given nine inoculations, and eleven Schick tests lasting over a period of twenty-two months, before he became Schick-negative. With regard to "reactions" after injection "toxoid-antitoxin floccules apparently do not give 'practical' reactions in children. Toxoid gives a few reactions in children of 10-15. . . . In adults and protein-sensitive reactors, toxoid may produce very unpleasant symptoms, and to this class "floccules" should always be given when available. In conclusion

the author gives it as his view "that three fortnightly doses of a reliable toxoid, if given to only half the population under the age of ten, would reduce the incidence and mortality from diphtheria to an extent that would make active immunization a sound financial investment, besides being of benefit to the public health." [This paper, taken in conjunction with a previous one by the same author (*Quarterly J. Med.*, 1928-9, 22, 321), provides an excellent review of the present position of Schick testing and active immunization in this country.] C. C. OKELL.

Reprinted from "Bulletin of Hygiene," Vol. 7, No. 10.

HASSMANN, K. Ueber Immunisierungsergebnisse mit der konzentrierten Diphtherieschutzsalbe nach Löwenstein. [**Immunization with Löwenstein's Concentrated Anti-diphtherial Ointment.**] *Muench. med. Woch.* 1932, v. 79, 871-2.

Immunization was carried out on a number of children with Löwenstein's concentrated toxoid ointment. The children were given three inunctions at fourteen-day intervals. Two weeks after the last inunction 57 out of 80 children had become Schick-negative, four weeks after the inunction 21 out of 23 were Schick-negative. On the other hand five months after the inunction only 35 out of 61 children were Schick-negative. It thus appeared that the immunizing effect is at a maximum four weeks after the inunction, while after five months many of the children have again become Schick-positive. It is suggested that, in order to maintain immunity, children should be given an immunity every three months. C. C. OKELL.

Reprinted from "Bulletin of Hygiene," Vol. 7, No. 10.

BESREDKA, A. Étude sur l'immunité locale dans la diphtérie. [**A Study of Local Immunity in Diphtheria.**] *Ann. Inst. Pasteur.* 1932, v. 48, 438-48.

In a previous communication [this *Bulletin*, 1931, v. 6, 683] the author described the local immunity of the rabbit's skin after certain treatment. This immunity was obtained after inunction with a cream containing diphtheria antitoxin, it also developed after inunction with a similar cream containing normal horse-serum and even after simple shaving of the skin. In the present paper this local immunity is further studied. The effect of inunction with a toxin-containing cream varied according to whether the antitoxin was given before or after the inunction. When given before there was no reaction even when the cream contained large amounts of toxin, when given after no reaction developed if the interval between the administration of toxin and serum was more than half an hour. In an animal previously treated by friction and having received antitoxin the non-specific immunity of the skin was reinforced by passive immunity. From

this the author concludes that the immunity due to shaving the skin is distinct from specific antitoxic immunity. Under cover of the immunity obtained by friction combined with that conferred by a small quantity of antitoxin, a rabbit is able to support massive doses of toxin. As a result of this treatment, which is practically a toxin-antitoxin immunization, a very solid local immunity may be brought about. C. C. OKELL.

Reprinted from "Bulletin of Hygiene," Vol. 7, No. 10.

Reviews.

A SHORTER ORTHOPÆDIC SURGERY. By R. Brooke, M.S., F.R.C.S. Bristol: John Wright and Sons, Ltd. 1932. 126 illustrations. Pp. 150. Price 10s. 6d. net.

This book does not cover the whole field of orthopædic surgery, nor is it designed for that purpose. It gives a well-arranged account of the various orthopædic conditions commonly met with in hospital and general practice. The ætiology, pathological features, diagnosis and methods of treatment are concisely described without going into great detail as regards operative procedures. The text is well provided with clear diagrams and photographic reproductions, as well as skiagrams. It should prove useful to house surgeons and practitioners. C. B. C. A.

FRAUD IN MEDICO-LEGAL PRACTICE. By Sir John Collie, C.M.G., M.D., J.P., Lieutenant-Colonel, R.A.M.C. London: Edward Arnold and Co. 1932. Pp. xi + 276. Price 10s. 6d. net.

This book is based on and is in fact an abridged edition of Sir John Collie's well-known work "Malingering," which is now out of print.

The author's unrivalled experience in this difficult class of work gives the book a very particular value.

There is a special chapter on Military Malingering which all R.A.M.C. officers should read; but the whole book is well worth their serious attention.

"NO NAMES, NO PACK DRILL." By F. H. Snow. London: Cecil Palmer. 1932. Pp. 563. 7s. 6d. net.

We fear that "No Names, No Pack Drill" is not likely to make a very general appeal.

The earlier half of the book is a very detailed and somewhat laboured description of the life of a R.A.M.C. private in England in the years immediately preceding the war, but it may be of some interest to the

men now serving to compare those days with the present ones—greatly to the latter's advantage we think!

The author describes an extremely unattractive life led by men so universally ill-favoured, physically, mentally and morally, that the story does not really carry conviction to the reader.

We have always thought "the Corps" was certainly not below the average in looks, but our author's experiences would give one a very different impression of the men then serving.

There is more to interest the general reader in the second half of the book, in which the author describes his life during the war years in France.

He sailed with the first British Expeditionary Force, and his service was devoted exclusively to sanitary duties, firstly as a private, later as a corporal. He therefore views the war from a somewhat different angle to that of most of the writers of War Time Memories.

We should like to think, however, that our men put up a better show than the author describes—the pleasant characters he meets could be counted on the fingers of one hand, whilst the "drunks" and the "skrim-shankers" are innumerable, yet the work they performed was of the utmost importance, and the description of the experiences of the sanitary staff at a rail-head during intensive shelling is amongst the best things in the book.

The horrors of the war evidently made a deep impression on a man of considerable sensibility, but even so we feel he looks upon his fellows and his official superiors with an unduly jaundiced eye.

A curious book which, incidentally, would be more "readable" if the author had adopted a simpler style.

MODERN METHODS IN THE DIAGNOSIS AND TREATMENT OF GLYCOSURIA AND DIABETES. (Modern Medical Monographs.) By Hugh Maclean, M.D., D.Sc., F.R.C.P. London: Constable and Co., Ltd. 1932. Pp. xii + 219. 14 Charts, 11 figs. Price 12s. net.

The fifth edition of this pioneer work is issued in a form similar to its predecessors.

The general arrangement of the work remains unchanged, as indeed does the greater part of the text. There is some additional space given to the problems of sugar tolerance and its variability under different conditions. The section on treatment is perhaps unduly conservative in view of modern practice. While we owe a great debt to the author for the earlier volumes of this work, we hardly feel that the additions to them at present justify a new edition.

Correspondence.

ANTI-MOSQUITO MEASURES.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I am afraid my description of the rifle ranges at Sialkot in the December, 1932, number of the Journal was not complete enough. It was an attempt to describe what is really a modification of the method advised by Northern Command Headquarters, India, from 1927 to 1928.

It was found at Sialkot that a trench on the outside of the surrounding wall held water for a considerable time; it acted like any ordinary borrow pit, which in fact it was, the surrounding wall having been made of earth removed to make the trench or gutter.

One of the principles of the modified method is to ensure that the surrounding wall completely encloses any cuttings, small depressions, or uneven edges of the big borrow pits.

Herring-boning on the bottom of the big borrow pit is again contrary to the principles of the modified arrangement as it drains the water from the area of the big borrow pit into the sump too rapidly.

The small wall round the sump pit is to prevent water pouring into it too quickly, and so enable as much as possible to be removed by percolation and evaporation.

I am etc.,

London,
January 19, 1933.

T. F. M. WOODS,
Captain, R.A.M.C.

Notice.

CONGRESS OF THE ROYAL SANITARY INSTITUTE.

THE 44th Congress of the Royal Sanitary Institute will be held this year at Blackpool, from June 17 to June 24, at the invitation of the Corporation.

The Right Hon. Lord Cozens-Hardy, D.L., is the President of the Congress and he will deliver the Inaugural Address to the Congress on Monday afternoon, June 19.

The work of the Congress will be divided into sections dealing with

Preventive Medicine.
Architecture, Town Planning and Engineering.
Maternity, Child Welfare and School Hygiene.
Veterinary Hygiene, and
National Health Insurance.

There will be special conferences of
Representatives of Sanitary Authorities.
Medical Officers of Health.
Engineers and Surveyors.
Sanitary Inspectors, and
Health Visitors.

A large Health Exhibition is being arranged in connection with the Congress.

LIST OF BOOKS RECEIVED AT THE ROYAL ARMY MEDICAL COLLEGE LIBRARY DURING THE PERIOD OCTOBER 1 TO DECEMBER 31, 1932.

Author(s)	Title of Work	Grant or Not
Walker	An Introduction to Dermatology	Grant
Lattes	Individuality of Blood	,,
McDowall	The Science of Signs and Symptoms	,,
Kingzett	Chemical Encyclopædia	,,
Sicard & Forester	The Use of Lipoidol	,,
Kelly & Ward	Electrosurgery	,,
Turner & Reynolds	Intracranial Pyogenic Diseases	,,
Strumpell & Seyfarth	A Practice of Medicine. 3 vols.	,,
Van De Velde	Ideal Marriage	,,
General Medical Council	The British Pharmacopœia. 1932	,,
Wyld	Universal Dictionary of the English Language	,,
Eckstein	Noguchi	Colonel A. C. H. Gray
Megroz	Ronald Ross, Discoverer and Creator	,,
Lipscomb	Diseases of Old Age	Author
Edwards	Diptera. (Fam Culicidæ. 194th Pt. Genera Insectorum)	Grant
Simon	Insect Vectors. Plates only	,,
Oriel	Allergy	L. & J. Committee
Soc. for Prov. B. C. Clinic	Birth Control. Public Health	,,
Williams	A Century of Public Health. 1832-1929	Grant
Cronshaw	Food Industries Manual	,,
Trumper & Cantarow	Biochemistry in Internal Medicine	,,
Choyce	A System of Surgery. 3 vols.	,,
McLean	Modern Methods in the Diagnosis of Glycosuria and Diabetes	,,
Boyd	A Textbook of Pathology	,,
Dorland	The American Illustrated Medical Dictionary	,,
Whitnall	The Anatomy of the Human Orbit	,,
Winton & Winton	The Structure and Composition of Foods	,,
Bramwell	Heart Diseases	,,
Bailey & Love	A Short Practice of Surgery. Vol. II	,,
Alexander	The Medical Value of Psycho-analysis	,,
Beaumont	Medicine	,,
Francis	Modern Sewage Treatment	,,

ERRATUM.

In line 15 of the Laboratory Notes by Major Hepple on the case of Tick Typhus, page 450, December number of the Journal, 1932, *after* "suggests" *read* "that the phenomenon of *infection inapparente* may have been present in G.P. No. 1."

Great Britain Army

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Journal OF THE Royal Army Medical Corps

ISSUED MONTHLY

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Journal of the Royal Army Medical Corps.

Original Communications.

ANTITYPHOID INOCULATION.

THE RÔLE OF BACTERIUM TYPHOSUM, STRAIN RAWLINGS.

BY LIEUTENANT-COLONEL H. MARRIAN PERRY, O.B.E.,
MAJOR H. T. FINDLAY,
AND
MAJOR H. J. BENSTED, M.C.,
Royal Army Medical Corps.
(From the Pathological Department of the Royal Army Medical College, London.)

THE successful introduction of antityphoid inoculation has, in no small measure, been responsible for the education of the public in the value of vaccine prophylaxis. Its employment by the British Army Medical Service has been followed by its adoption by the Medical Services of other countries, and it is beyond question the most common prophylactic vaccine now used.

The observations of Wright on the possibilities of vaccine prophylaxis against typhoid fever were followed by the prolonged and detailed investigations of the Antityphoid Committee (1912). The greater part of the laboratory research was undertaken by Leishman and his co-workers, and as a result, after successful field trials in India, a typhoid vaccine became available which was extensively used by the Army in endemic areas with pronounced success in diminishing the incidence and mortality of the disease.

It is interesting in the light of present knowledge to recall how the strain of *Bact. typhosum*, used in the vaccine, was chosen. The selection

of this strain was apparently made mainly on the basis that it readily yielded an even and homogeneous emulsion which was essential for the performance of opsonic tests that formed part of the research. Additional factors in favour of its employment were its "low virulence" and "proved suitability for inoculation" (Leishman 1905). This strain, now well known as the Rawlings strain, has been most jealously preserved throughout subsequent years and has always been included in the Army typhoid vaccine. Indeed, there are few laboratories in this or other countries, engaged in vaccine manufacture, that have not employed it as their typhoid element. *Bact. typhosum*, Rawlings, was originally isolated from the spleen of a fatal case of typhoid fever occurring at Netley in 1900 and has thus been continually used over a period of thirty-three years.

In the succeeding years certain modifications have been made in the technique of manufacture of the vaccine. Saline suspensions have replaced the old broth emulsions, and soon after the commencement of the Great War *Bact. paratyphosum* A and *Bact. paratyphosum* B were included in the vaccine, but the original Rawlings strain was retained.

The Antityphoid Committee, after analysing the figures following the antityphoid inoculation of troops in India, came to the conclusion that the case was strongly in favour of inoculation and, in spite of certain criticisms that have been made regarding the statistical analysis of the results obtained during the War, there can be no question that the use of this vaccine, both in the British and Allied Armies, was a proved success. The incidence of the enteric group of diseases was markedly diminished, and the mortality-rate amongst such cases as occurred was reduced.

Since the War, however, our knowledge of the antigenic composition of bacteria has been extended by the recognition of the multiplicity of antigenic components which go to make up their structure (Weil and Felix, 1917, Arkwright, 1920, etc.), and the appreciation of these facts has profoundly modified our old conceptions of the criteria which may be accepted as indicative of immunity (Whitehead, 1927; Ibrahim and Schütze, 1928; Topley, 1929; Schütze, 1930).

In the light of these new observations it is evident that the degree of the various types of agglutinins induced as a result of the inoculation of Rawlings strain can in no way be considered as a measure of immunity against typhoid fever. This fact, taken together with the demonstration that the protection afforded by the inoculation of a virulent organism is much greater than that conferred by its non-virulent prototype, suggested that further investigation of the protective property of the Rawlings strain was indicated.

Apart from these considerations, although no reliable figures can be quoted, the feeling amongst those working in endemic areas of typhoid appears to be that the vaccine, as at present constituted, has not yielded the maximum resistance to infection. This impression has been conveyed

to us by personal communications from Army bacteriologists. In the absence of any carefully planned and controlled field experiment published statistics may obviously be misleading.

In our opinion it would not have been justifiable to discard the Rawlings strain from the present typhoid-paratyphoid vaccine on such data as have been until recently available, and to substitute a more recently isolated strain of typhoid bacillus of a higher degree of virulence. The Rawlings strain had apparently given, over a period of years, such excellent results in field experiments that were without parallel and which under present conditions could not be repeated.

Investigations were commenced by us some years ago on the comparative value, as an immunizing agent, of various strains of *Bact. typhosum*, including the Rawlings strain, and of modifications in preparing suspensions of the organisms, with the object of producing a more effective vaccine. The main difficulty, however, has been to assess by laboratory experiments the immunity conferred by such vaccines.

Our attention has, however, recently been directed to a research by Grinnell (1932) on the dissociation of Rawlings strain of *Bact. typhosum* and on its suitability for use in antityphoid vaccines. In this communication the study of a number of Rawlings strains and their protective capacity, using mice as the test animals, was described. Briefly, it was determined, in an unequivocal manner, that various Rawlings strains, used as vaccines, failed consistently to protect mice against a subsequent lethal dose of a virulent strain of *Bact. typhosum*, whereas a series of mice previously inoculated with a vaccine manufactured from a recently isolated virulent strain were effectively protected against a similar test dose. This work was so significant that we have considered it necessary to repeat and extend it. The present communication is concerned with the results that have been obtained.

The evolution of Bact. typhosum, Rawlings.

As noted in an earlier part of this article, strain Rawlings was selected on the basis of its low virulence. It seems, therefore, safe to presume that soon after its employment as a typhoid vaccine it must have displayed a tendency towards roughness. It is evident that in the years that have passed this tendency has become markedly accentuated, and at the present time it is impossible to obtain a typical smooth colony from this culture. Despite all the usual procedures directed towards this end the colonial characteristics remain definitely and typically rough. In addition, the strain exhibits indifferent agglutination with a smooth somatic serum, whilst agglutinating well with a rough serum. Nevertheless its "O" agglutinogenic capacity is marked. It seems a fair assumption that in the earlier years this strain was in an intermediate stage between smooth and rough, and was capable of inducing a satisfactory degree of immunity. Its evolution during the succeeding years has been towards complete roughness

and indeed, if the recent work of Bruce White (1932, 1933) is accepted it may be that dissociation has progressed even beyond this stage during its long subculture on laboratory media.

As supplementary to colonial formation Grinnell utilized stability of emulsions in normal saline, and growth in 10 per cent. normal horse-serum broth, as criteria of the roughness of the strain. Whilst, in the main, agreeing with his findings, we have observed a point that merits mention. With regard to the stability of normal saline suspensions he reports twelve out of thirteen of the Rawlings strains he employed as stable. We have found, however, that emulsions made with rough strains and observed over a period of days rapidly sediment, whereas emulsions of smooth strains remain in suspension over a much longer period. Rawlings strain invariably behaves in the former manner.

Present degree of virulence of strain Rawlings and determination of virulence of strains employed in the investigations to be described.

It is not possible to say what degree of virulence was associated with strain Rawlings at the period it was originally chosen. Leishman and his co-workers, on the basis of finding little difference in opsonic and agglutinin production between virulent and non-virulent organisms, laid little stress on the point beyond stating, as has already been noted, that strain Rawlings "was of very low virulence." Grinnell, in his work, estimated virulence by a determination of the number of bacilli killed by a given quantity of fresh defibrinated guinea-pig's blood and by the lethal effect on mice.

With regard to the bactericidal tests, he found that fresh guinea-pig's blood had practically no action on smooth typhoid bacilli, whilst its bactericidal action on the Rawlings strain was marked. The results of his comparative virulence tests of the Rawlings and smooth strains on mice were even more conclusive. In the case of Rawlings strain, only 3·3 per cent of the animals were killed by the test dose employed—0·1 cubic centimetre of an eighteen-hour broth culture. A similar test dose of a smooth typhoid organism yielded a mortality of ninety-five per cent.

In repeating this work we have followed the technique used by Grinnell in his bactericidal tests, but our findings, although in the main confirmatory, have not been so uniform. In spite of repeated examinations, the results were so irregular that, beyond the demonstration that the bactericidal power of guinea-pig's whole blood was greater on Rawlings strain than on the smooth strain employed, and inconstant in the case of rough variants of the smooth strain, an accurate estimation of virulence by this method was not possible.

In contrast, the mouse inoculation tests yielded most striking and consistent results. Primarily, it was necessary to confirm Grinnell's observations on the difference in virulence between the Rawlings strain and recently isolated smooth strains. No difficulty was experienced in this

determination. His technique of employing an eighteen-hour broth culture and the intraperitoneal route of inoculation was followed. Whilst he stated, however, that he had found it impossible with any precision to define variation in virulence in terms of a minimal lethal dose, it appeared desirable that if this could be ascertained with any reasonable degree of accuracy it should be attempted. When the infecting dose was above 200 million organisms, it was necessary to use standardized saline suspensions prepared from twenty-four-hour growths on agar slopes, otherwise the inoculum would be too large. Employing small series of mice and infecting doses ranging from 200 million up to 10,000 million organisms it was ascertained that the minimal lethal dose of the Rawlings strain was in the region of 500 millions. Our criterion of a minimal lethal dose was the number of bacilli that would cause death from septicæmia in 100 per cent of the mice employed in the test.

An attempt was then made to ascertain by quantitative tests a comparison of the virulence of the Rawlings strain and some recently isolated strains. The selection of these latter strains for the virulence tests was made possible through the kindness of Dr. W. M. Scott, who supplied us with cultures from the recent Malton outbreak of typhoid fever. These were supplemented by certain Indian strains isolated within the last two years, in particular strain Allahabad, with which we had already carried out extensive serological work and which had been employed in our previous vaccine investigation. Even though they had recently been isolated, careful colony selection was necessary as the usual rough variants were constantly encountered. In contrast with strain Rawlings which killed mice in doses of 500 millions, the strain Allahabad was found to be lethal in a dose of 40 millions. With the exception of one strain—Watson—the various organisms from the Malton outbreak failed to kill mice regularly in this latter dose. Subsequently, it was found possible to enhance the virulence of some of these strains by passage, but they never attained the degree and constant virulence of strains Allahabad and Watson. These organisms killed 100 per cent of mice in a dose of 40 million organisms within forty-eight hours.

At this stage of the investigation, the contrast in virulence between the smooth and the rough variants of the Allahabad strain was very evident.

The comparison in various respects between the strains Rawlings, Allahabad and its variants, and Watson is illustrated in Table I.

The efficiency of vaccines manufactured with Bacterium typhosum, strain Rawlings, and a recently isolated strain as assessed on the basis of mouse protection experiments.

In the hands of Grinnell, the reactions of immunized mice to a test dose of an organism of previously determined virulence appeared to have been a satisfactory method of comparison of the protective power of vaccines made from different strains. The results that we have obtained find us in

agreement with this conclusion. Whilst this observer records the difference in protective power between the Rawlings strain and a recently isolated smooth strain, it is not stated that this comparison was extended to rough variants of recently isolated organisms. As will later be evident, we have conjectured on the possibility that, as early employed in the typhoid vaccine, Rawlings strain was in an intermediate phase. To obtain some evidence in support of this contention, in addition to repeating Grinnell's work, the comparative value, as an immunizing agent, of smooth organisms and their rough variants was made.

Vaccines were prepared from the Rawlings strain and from the strain Allahabad and its rough variant. They were standardized to contain 500 million per cubic centimetre, and were made in the following manner:—

(1) RAWLINGS VACCINES.

(*a*) Grown in broth for eighteen hours, killed by heating to 56° C. for one hour and preserved with 0·5 per cent. carbolic.

(*b*) Saline suspension from growth on agar, killed by heating to 53° C. for one hour and by the addition of 1 per cent. carbolic, and subsequently diluted to a carbolic content of 0·5 per cent., i.e., the present technique we employ in the preparation of Army typhoid vaccine.

(*c*) Saline suspension from growth on agar, killed by formalin and preserved by the addition of 0·5 per cent. carbolic.

(2) ALLAHABAD, SMOOTH VACCINES.

(*a*) Prepared as in (1) (*a*) above.
(*b*) Prepared as in (1) (*b*) above.
(*c*) Prepared as in (1) (*c*) above.

(3) ALLAHABAD, ROUGH VACCINES.

(*b*) Prepared as in (1) (*b*) above.
(*c*) Prepared as in (1) (*c*) above.

A total of eighty mice was used in this immunization experiment. They were divided into batches of ten and each batch received one of the above vaccines. The technique of inoculation was as follows: Each animal was given, by the intraperitoneal route, two doses of 50 and 100 million organisms respectively, at an interval of five days. To avoid any fallacy that might arise by the intraperitoneal injection of varying volumes of fluid the vaccines were so diluted that the appropriate dose amounted to 0·5 cubic centimetre at each inoculation. In all cases there was a definite reaction following the injection. This made its appearance within an hour and was evident from the altered condition of the animals' coats, shivering fits and refusal to feed. After an interval of fourteen to sixteen hours recovery was complete, their coats had resumed the normal appearance and they had commenced feeding. Whilst this was the sequence of events in the case of inoculation with saline vaccines, the reaction following the

TABLE I.—COMPARISON BETWEEN STRAINS RAWLINGS, ALLAHABAD (ROUGH AND SMOOTH) AND WATSON.

Organism	Rawlings	Allahabad (smooth).	Allahabad (rough)	Watson.
Motility.	Motile.	Motile.	Motile.	Motile.
Colonial appearance.	Rough.	Smooth.	Rough.	Smooth.
Sedimentation rate in saline suspensions	Very rapid.	Very slow.	Rapid.	Very slow.
Agglutination with HO serum O serum Rough serum	 marked. indifferent. normal.	 normal normal none.	 marked. normal normal.	 normal. normal. none.
Agglutinin response H. O Rough	 very good. good good.	 good good. none.	 very good. good. moderate.	 good. good. none
Percentage mortality in mice following Virulence test of 40 million organisms	0%.	100%.	14%	100%.

NOTE: In order to avoid confusing the issue, the serological behaviour and the agglutinogenic properties of the strains used have alone been recorded. Any detailed analysis of these results has been omitted intentionally, as it has been desired to emphasize the greater importance of actual protection tests rather than complex serum response to immunization.

broth suspensions was much more marked, especially with the vaccine made from the Allahabad smooth strain.

After an interval of ten days the test dose of virulent living organisms was administered by intraperitoneal inoculation. The selection of organism employed to determine the measure of protection was carefully made. It has been noted previously that the virulence of some recently isolated strains from the Malton outbreak had been examined. With the exception of one—strain Watson—which had killed 100 per cent of mice in a dose of 40 million organisms within forty-eight hours, they had shown considerable variation in this respect. In all the tests the organism Watson, however, had displayed a remarkable consistency in its degree of virulence. For this reason, and also from the fact that it was desirable to test the protective efficiency of the Allahabad vaccine against a strain from a different source, the Watson strain was chosen as the test strain for resistance.

To obviate, as far as possible, any error that might arise due to the possible varying resistance of the animals it was decided to employ as a test dose double the number of organisms that had previously been determined as the minimal lethal dose, i.e., 80 millions.

The results of these protection tests will be best appreciated by reference to Table II.

It will be evident from this table that the results have been most consistent. In every instance the uninoculated controls were killed within twenty-four hours by the test dose of virulent organisms. The lack of immunity conferred by the different varieties of vaccine manufactured from the Rawlings strain is in sharp and striking contrast to the protection afforded by the vaccines made from the more recently isolated smooth strains.

It is also to be noted that whilst the vaccine prepared from the Allahabad smooth strain was most effective, the vaccine made from its rough variant gave almost as satisfactory results.

The animal protection experiments recorded in Table II were made at the same time and the mice employed were derived from the same stock. For this reason and for the sake of clarity we have limited the illustration of the protocol to one series of experiments. It must, however, be mentioned that they have been repeated with confirmatory results with mice derived from a different stock.

It is not to be assumed that the Rawlings strain, even at this stage of its evolution, had failed to confer any immunity. It appears evident from the following experiment that its value as an immunizing agent, although inferior, is not negligible: A series of ten mice was inoculated with a vaccine made from the Rawlings strain in a dose of 50 millions. Ten days later their immunity was tested by the injection of 40 million organisms of the virulent test strain. Four out of the 10 survived, 3 died within forty-eight hours, whilst the death of the other 3 was delayed for five days.

At the present time there is considerable difference of opinion regarding the duration of the period over which typhoid-paratyphoid vaccines—and indeed all varieties of vaccine—retain their maximum value as immunizing agents. Such expiry dates as have been affixed to different vaccines have been selected on an empirical basis. So far as the Pathological Department of the Royal Army Medical College is concerned, where the preservation of large reserves of typhoid vaccine is desirable, the procedure has been uneconomical as it has necessitated from time to time the destruction of quantities of vaccine that had passed the expiry date. It should now be possible to estimate the rate of deterioration, if any, due to storage of this vaccine.

To obtain some data bearing on this question quantities of the vaccines used in this investigation have been retained, and have been stored both in the cold room and at ordinary temperatures. Mouse protection tests are being undertaken at regular intervals. In this manner it is hoped that some more definite data than have hitherto been available, regarding retention of potency, may be obtained.

It will also be of interest to observe the duration of the maximum degree of protection afforded to mice by preventive inoculation. This should be readily ascertainable by the injection of a test dose of virulent organisms administered at varying intervals to a series of animals that has been immunized at the same time. This work is in progress and its results should have some bearing on the question of re-inoculation of troops stationed abroad, a point on which more information is at present required.

Discussion.

It has been noted in the earlier part of this communication that there has been a growing feeling amongst Army laboratory workers that the typhoid vaccine was not yielding the maximum degree of protection. This applied particularly to the typhoid component. For a variety of reasons it has not been possible to undertake in recent years any carefully controlled field experiment on the lines of that conducted by the Antityphoid Committee in the earlier years of the adoption of this vaccine. In the light of new investigations it appears logical to assume that the strain of typhoid bacillus always employed in the army vaccine had probably undergone dissociation to an extent that rendered it unsuitable as an immunizing agent.

Although at the present time it can only be hypothetical, in our opinion the Rawlings strain was when introduced a most effective protective antigen. Support for this hypothesis is to be found in the statistical records of its employment. We are not justified in assuming, however, that at the time of its adoption it was superior to any other recently isolated strain in its immunizing properties, as animal protection experiments did not form a part of the original investigations.

In view of the fact that in its early days this strain was stated to be of

TABLE II.—RESULTS OF IMMUNIZING EXPERIMENTS.

UNINOCULATED CONTROLS	■ ■ ■ ■ ■ ■ ■ ■ ■ ■
RAWLINGS VACCINE	
a. Broth Suspension	■ ■ ■ ■ ■ ■ ■ ■ ■ ■
b Agar Washing killed heat-carbolic	■ ■ ■ ■ ■ ■ ■ ■ ■ □
c Agar Washing killed formalin	■ ■ ■ ■ ■ ■ ■ ■ ■ □
ALLAHABAD SMOOTH VACCINE	
a. Broth Suspension	* ■ □ □ □ □ □ □
b. Agar Washing killed heat-carbolic	□ □ □ □ □ □ □ □ □ □
c. Agar. Washing killed formalin	■ □ □ □ □ □ □ □ □ □
ALLAHABAD ROUGH VACCINE.	
b. Agar Washing killed heat-carbolic	■ ■ ■ □ □ □ □ □ □ □
c Agar Washing killed formalin	■ □ □ □ □ □ □ □ □ □

■ : Mouse dead of septicaemia within 48 hours.

□ : Mouse alive & well at end of 48 hours

* · 3 mice did not recover from the severe reaction produced by this vaccine hence only 7 were available for the test dose.

"very low virulence" it can, we consider, be assumed that it was in a phase that is termed intermediate. It is evident that had it been a predominantly smooth organism its virulence would not have been described as very low. The probability, however, that at this time it was in an intermediate phase in no way indicates that its immunizing property was not satisfactory. We have noted that strains in this phase, of proved low virulency, have conferred satisfactory protection in mice.

The difficulties, however, that have been referred to, of assessing by field experiment the degree of protection afforded by the Rawlings strain, and its unquestioned successful employment over a period of years, made us naturally diffident of advocating any change unless a different strain could be shown by laboratory investigation to be definitely superior as a vaccine. In default of actual field experiments, we are in agreement that the mouse protection test affords a most valuable laboratory procedure for the determination of the resistance to infection afforded by a typhoid vaccine.

In view of Grinnell's work, and of the above investigation which we have carried out, we are of the opinion that the Rawlings strain should be discarded and the strain Allahabad substituted for it in the Army typhoid-paratyphoid vaccine.

This Allahabad strain was isolated from a case of typhoid fever in India two years ago and has been chosen as it has been employed in our investigations and has been proved to be an effective antigen. Further, we have had considerable experience of it in serological work and have used it in a number of experimental inoculations in man without undue reaction. Although the strain is predominantly smooth, rough colonies are thrown off that are comparatively avirulent. Notwithstanding the fact that we have found little difference in the protective property of vaccines made from the smooth and from the apparently rough phase, preference by colony selection of the normal smooth organism is recommended. It is considered that the present stage of evolution of the Allahabad strain is analogous to that which strain Rawlings had reached in the earlier years of its employment.

To assist in retaining the smooth characters of the Allahabad strain we have, at the suggestion of Dr. W. M. Scott, preserved this organism on inspissated egg-medium which has been found to discourage the production of rough variants.

The mouse protection test is now incorporated, in so far as the typhoid element is concerned, in our routine examination after preparation of the vaccine.

It is probable that the paratyphoid components of the vaccine are amenable to investigation on the same lines, and work in this direction is being undertaken. It may be that substitution of the strains of paratyphoid organisms at present employed may be indicated.

Conclusions.

(1) It is confirmed that Rawlings strain of *Bact. typhosum* is practically non-virulent and, judging from mouse protection tests, its value as an immunizing agent has markedly deteriorated.

(2) It is considered that sufficient data now exist to justify the substitution of another strain of *Bact. typhosum* in the Army typhoid-paratyphoid vaccine.

(3) The selection of an alternative strain should be made on the basis of the resistance of mice immunized with a vaccine manufactured from such a strain to at least double the minimal lethal dose of virulent living typhoid bacilli.

(4) Provided the strain of organism is selected on the basis of mouse protection, modifications in the details of manufacture of the vaccine, such as broth suspensions, saline heat-killed suspensions, saline formalin-killed suspensions, do not appear, on the results of such limited trials as have been made, to be of great moment. The reactions with broth suspensions obviously preclude their use.

(5) The mouse protection test affords an important criterion in the estimation of efficiency of different batches of vaccine.

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DOWN SOUTH.

By U. P. A.

II.—To Adam's Bridge.

(*Continued from p. 125, vol. lx.*)

In 1791, during the course of the third Mysore war, Bangalore was wrested from Tipu Sultan by a British force under Charles, 1st Marquis and 2nd Earl Cornwallis. Any officer who may feel depressed on counting the "average" entries on the second page of his Annual Confidential Report, would do well to study the life of Lord Cornwallis. Such a study will prove a sure antidote against an inferiority complex, for the life of this great soldier-administrator is a long record of sound, honest, unselfish labour carried out from a sense of duty and inspired by high ideals. Cornwallis was not brilliant—but he was something better: he scorned to play to the gallery, or to anything else but his own exacting conscience; and "if not a man of startling genius, he was a clear-sighted statesman and an able general, as well as an upright English gentleman."

In those days Seringapatam became the principal military station in this district; but it proved to be extremely unhealthy, and, as Bangalore was noted for its salubrious climate, the British troops were moved from the former to the latter place in 1811.

From 1831 to 1881 Mysore State was under British administration. In 1881 the State was handed back to the old Hindu ruling house—Bangalore city and cantonment (an area of 13½ square miles) excepted. This area, then, became a British enclave within a native State.

It was during these years—the era of the sailing ship—that large numbers of British soldiers settled down permanently at Bangalore as pensioners; and the place remains one of the chief centres of the domiciled community to this day.

We found Bangalore clean and cool, fresh and verdant. Georgina and I spent the afternoon driving round the cantonment, and to us it seemed as English as any place in India is ever likely to be. The village green, dotted with groups of people playing games, and surrounded by shops, offices and dwellings formed a picture which you would look for in vain in Lucknow or Lahore. The gardens, the trim houses, the well-kept roads—everything combined to produce an air of peace, stability and contentment. Of course that was a mere impression, and circumstances alter cases: possibly these remarks may cause some of those who are quartered at Bangalore to smile. Well, there are different kinds of smiles. In this case the appropriate type is the smile complacent. If there be any who favour the smile incredulous, let them apply for immediate transfer to

Bannu or Barrackpore. But surely there are none so foolish, for the reputation of Bangalore is founded on solid fact.

I once met a man who had served in this delectable station on no fewer than seven separate occasions. How he had managed to do this heaven—and he—alone knew; and of course, he was not bursting with information on the subject.

Have you noticed that, in every big and pleasant station there is a superior, autocratic clique composed of about half-a-dozen of the older inhabitants, but that the oldest inhabitants—three or four—do not belong to the charmed circle? The position of the latter is such that quiet self-effacement is essential to self-preservation; it is only by accident you discover how these good people stand. I remember one delightful station in which an engineer (P.W.D.) had been anchored for twenty-seven years, a military medical officer (I.M.S.) for twenty-three years, and a British combatant officer (attached I.A.) for eighteen years. All three agreed that there was only one station of any account at all in India; and also that The War was the greatest calamity of their lives since, for a year or two therein, they were forcibly torn from their beloved Barnaclebad.

In contemplating such examples of human fortune—or is it ingenuity? —the mind is filled with three dominant emotions: envy, admiration and amazement. Envy is engendered, for most of us "live on our boxes"; admiration is elicited by a feat which is quite out of the ordinary; and amazement is evoked as we realize that the age of miracles has not yet come to an end.

Early on March 9 we left Bangalore, bound for Madras, distance 211 miles.

Despite its length, this was a very pleasant run, for the scenery varied constantly although of a typical south Indian character.

Kolar town is 42 miles east of Bangalore, and a short distance north-west of the famous Kolar goldfields. It is known that this once precious metal has been obtained from this area for centuries, but the output was comparatively insignificant until the introduction of Western methods of prospecting and mining.

We did not pay a visit to the goldfields, "because"—as Georgina said—"the appearance of two staunch sterlingites would tempt every French and American sentry in the area to shoot. It isn't worth the risk."

Kolar town and district are renowned for certain products which are so Catholic in kind and so important in character, that a whole library of learned books might be written on their uses, abuses, virtues and defects. These products are :—

(1) *Mulberry trees*, for the rearing of silk worms. Is there a woman who prefers artificial silk to the real article? No: there is no such woman.

(2) *Gold*, lack of which is said to be the root of all evil: so men sally forth to mine the gold which is to buy the silk.

(3) *Blankets,* for protecting the poor men, who have to work in all weathers.

(4) *Turkeys* for the Christmas feast, when the women wear their finest silken raiment, and the men fortify themselves for the ensuing twelve months' spell of hard labour.

Verily, Kolar is an epitome of Life itself.

If this journey be regarded solely from the keen motorist's standpoint, then it must be admitted that travelling through the Bombay Presidency and Mysore State is full of vexations and hardships. The scenery is a compensation: it is often varied and beautiful. In the Madras Presidency the roads are excellent; but one must be sure of one's route, for it frequently happens that important river crossings are not bridged, and rain renders them quite impassable. The scenery, if not very attractive, is usually interesting. In all three provinces the dâk bungalows are archaic, and often worse; and the more Indianization proceeds, the more objectionable do these places become. To this general rule there are exceptions, but they are very few and far between.

Thirty miles east of Kolar we paid our last toll, and were soon bowling along a fine, smooth motor road. What joy and relief, despite the fact that the surface was old-fashioned macadam, innocent of tar!

We had crossed the frontier between Mysore and Madras.

Most of us know something of The Mutiny, with its long list of horrors and its dearth of lessons of any military value; and we know something of The Frontier, with its recurring campaigns in which the same military lessons crop up over and over again; but, compared with these, few of us know much about the wars of the Carnatic, although these wars were embellished with enough of romance, gallantry and martial material to stimulate the most jaded military student. It is curious to reflect that the Madras Presidency or (to give it its real, and appealing, title) the Presidency of Fort St. George, is now but a lumber room of history, its glitter dimmed, its import shrunken, its vitality extinguished. Once the tide of world history flowed Carnatic-wards in flood. Over a hundred years ago the waters ebbed and, since then, the Carnatic has remained stranded on the distant shore of forgotten things.

The modern Carnatic, i.e., Kanarese, or Tamil country, comprises the districts of Arcot, Madura and Tanjore. In fact, it stretches from Cape Comorin to the Northern Circars (a tract of country at the north-west corner of the Bay of Bengal) and from the east of the Eastern Ghats to the Coromandel coast.

Think of the names associated with this region: the great Portuguese seaman-adventurer, Vasco da Gama, who arrived off Calicut in 1498: the renowned Hindu general, Swaji: the astute, persistent Frenchman, Dupleix: the Moghul nawab, Fateh Muhammad, his son the spirited

Haidar Ali, and his grandson the ferocious Tipu Sultan; and finally the British Clive, Coote and Wellesley—a trio whose talents were as varied as their actions were brilliant.

And yet, in spite of all this—in spite of the fact that here the issue of British supremacy in the East was fought and decided—the book of the Presidency of Fort St. George is anything but a best-seller nowadays.

At Chittoor the road swings south-east to south, following the course of the Poini river to its junction with the Palar. Here a bridge crosses the Poini to the north bank of the Palar, and here—about 142 miles from Bangalore—are situated the towns of Ranipet and Walajapet. Arcot faces them, on the south bank of the river. Ranipet, the European quarter of Arcot, used to be a big cavalry cantonment, and many buildings connected therewith are still standing. Walajapet, a thriving little manufacturing and trading centre, has supplanted Arcot as the chief commercial town in this area. Arcot, once the stormy capital of the Nawabs of the Carnatic, is now in decline: the year 1751 marked the beginning of its end, for it was in that year that Clive and his contemptible little army performed one of the most brilliant and remarkable feats in British military history.

Undoubtedly Clive's capture and defence of Arcot is an epic. At this particular time Clive was really a quill-driver or, at the most, merely a soldier in embryo. His eight officers were even less experienced. The force under his command was ridiculously inadequate for the task, and the British element was weak. However, bluff, surprise, audacity and skill combined to effect the capture of the place almost before the enemy realized what was afoot.

The defence of Arcot lasted for fifty days. It is replete with stirring and heroic incidents; and the tale of the final assault—and repulse—as told by Macaulay is as fine a yarn as one could wish to read.

Arcot surrendered to the French in 1758, but was retaken by Colonel Coote in 1760. In 1780 it was captured by Haidar Ali from Nawab Muhammed Ali who was holding it on behalf of the British. The final curtain was rung down on Arcot when it passed to the British in 1801—the year in which the Carnatic was ceded.

Perhaps you are of the same way of thinking as Georgina: perhaps, with her, you say: "A little of history goes a long way. Too much of it produces indigestion."

Maybe you are right: who knows?

Woe betide the doctor who becomes entangled in the meshes of History, for History and Medicine are alike inasmuch as no man can ever hope fully to master either.

Sufficient unto the day is the specialism thereof.

It is impossible to know everything about Medicine: it is tempting to know all about a part. Even so, the latter course entails much expenditure of time and labour, and is followed inevitably by more or less narrowing of

the field of vision—a drug aversion, a knife repulsion, or a tonsil-local-sepsis complex as the case may be.

And so it is with History.

Woe betide the doctor who makes a hobby of History, for he does but intensify his existing difficulties.

There may be—and no doubt there are—some specialists in Medicine who would protest against these remarks; but what would they say to this?—

Generals Smith, Jones and Robinson are standing on the left bank of the Palar, gazing across the river towards Arcot. They are accompanied by their A.D.'sM.S., Colonels Brown (ex-E.N. and T.), Black (ex-Dermatology) and White (ex-general duty).

Genl. Smith.] "By the way, Jones, is there not some story connected with Arcot?"

Genl. Jones.] "Yes, I believe so; but I'm damned if I can remember it. My speciality is cavalry in the American Civil War. But do you not know something about it?"

Genl. Smith.] "Why should I? Naturally, I have forgotten it—years ago—confound you! Don't you remember I specialized in Napoleon Crossing the Alps? Come on, Robinson."

General Robinson, who has never specialized, and is not even *p.s.c.*, in a somewhat apologetic manner tells the story of Arcot.

Genl. Smith.] "How many rounds of grape and canister per gun were at Clive's disposal?"

Genl. Jones.] "What was the daily ration allowance of mango chutney?"

Genl. Robinson.] "I'm afraid I do not know."

Genls. Smith and Jones.] "What? 'Don't know?' Merciful heaven! Let's leave the mouldy old place."

Colonels Brown and Black, while acting in a manner consonant with strict professional etiquette as practised in the best circles, are, of course, amazed and horrified at this conversation.

On regaining the headquarters' mess, Colonel White shatters several laws, written and unwritten, by standing General Robinson a drink. A few minutes later General Robinson emphasizes the offence by returning the compliment.

The essence of charity is found amongst the outcast and down-trodden.

Before the evening is over, Colonels Brown and Black agree that General Robinson should have his tonsils enucleated and be supplied with a hair wash; while Colonel White is consulted by General Smith (laryngitis) and General Jones (gouty eczema).

How manifold are the workings of the law of compensation.

Once upon a time there was a sweet maiden who was bidden to hold goodness before cleverness; but only those who have delved into History or Medicine—or, better still, into both—can appreciate fully the wisdom of this piece of advice: it is subtle, it is profound, it is superlative.

MADRAS.

Clive kissed me on the mouth and eyes and brow,
Wonderful kisses, so that I became
Crowned above Queens—a withered beldame now,
Brooding on ancient fame.

This is a good example of Kipling's deft touch and acute observation.

Not only is the beldame withered: here and there she is bedraggled. Probably this is the result of carelessness—the carelessness which is so apt to beset old age, even in the ranks of the aristocracy. It can hardly be due to poverty: the place seemed to be full of life and activity, especially in the vicinity of the docks. Besides, it is said that the trade and general prosperity of Madras have benefited much from the prolonged stagnation of business in Bombay.

We put up at a hotel of good repute. It shall be nameless. The servants were mannerless and dirty, the rooms were shabby and untidy and the meals were rough and badly served. A written complaint containing sundry unsavoury details was sent to the manager. It was ignored. The bill, so far as "steepness" goes, was above reproach. Under certain conditions a hotel can afford to treat birds of passage in a casual manner; but in a country where servants are cheap, plentiful and efficient, there is no excuse whatever for dirt.

In the evening we drove along the Marina. This is a magnificent esplanade, in length and breadth on the grand scale. But while the sky was a void and the sea an expanse empty to the horizon, the earth was hidden by humanity in hundreds and thousands. Men, women and children, swarthy, swarming, sweating, covered the sands and crowded the foot-walk. The roadway was lined with innumerable motor cars, closely parked. It looked like an open-air, and somewhat flashy, automobile exhibition. The heat was not intense, but humidity was excessive. One was impressed with the fact that the open spaces of a great city are its lungs.

The return drive in the twilight, past the ancient cathedral of St. Thomé, and via some of the oldest quarters of the city, was picturesque. It was also dusty and odoriferous—as befits the picturesque in India.

The following day was a mixture of sunshine and shadow. I called at the G.P.O., a building which is imposing without, but somewhat dingy within. I halted at a grille labelled "Poste Restante." Behind the grille sat Sweet Seventeen. She had an olive complexion, full, red lips and big brown eyes. Her features were regular and good: an attractive lass. Alack! she was over-worked, or worried, or something of the sort, for her beautifully arched eyebrows were contracted into an almost continuous line, the dimples at each end of the Cupid's bow tended to flatten out, and her dark pupils sparkled and misted over alternately, with a speed and contrast which left one breathless with excitement, fear and delight.

Again, alas and alack! with all the assurance and independence of post-War femininity, she had no need of my help, or advice, or even of my presence. At least, so it seemed to me because, for a full five minutes, she behaved as if I were a thousand leagues distant from "Poste Restante," G.P.O., Madras.

I mention the period, five minutes, with diffidence. To me it seemed like five seconds; but a cruel, inexorable clock, situated just above Sweet Seventeen's raven tresses, marked the passage of time. When next I visit the G.P.O., Madras, I shall take with me a present for that miserable clock: a jam tin bomb. Had I been provided with a high stool, and had the close proximity of the grille not prevented me from leaning my elbows on the counter, five hours would not have seemed too long to wait.

What was she studying? An admonition from higher authority? Perish the thought! A succession of petulant pouts and fierce little frowns might lend support to such a surmise; but what of those suppressed sighs and evanescent smiles which, as they struggled for physical expression, were stifled ere they matured?

A troublesome love-letter? A doubtful proposal of marriage? Yes, unquestionably.

Five and a half minutes.

I wondered if Georgina were enjoying the street-scene—dockland—from the car, below.

I hummed a little tune—softly, to be sure. With due regard to the circumstances and environment, I considered a marine ditty the most appropriate:—

One Friday morning we set sail,
And, when not far from land,
We all espied a fair mermaid
With a comb and a glass in her hand;
The stormy winds they did blow.

I drummed with my fingers on the grille—gently, of course.

Sweet Seventeen spoke.

Her words came crystal-clear. I would not say that she snapped or barked: such a description would be unseemly. Nor would I say that her voice sounded like a machine-gun before Bourlon Wood on a cold and frosty morning, for I do not think it did. Rather would I liken the enunciation and timbre to the musical measure *staccato tutti con ardente.* Perhaps she had mistaken me for one of those rough, uncouth, hairy fellows who go down to the sea in ships; and, for that reason, had employed a mode of address utterly at variance with her true self. A wave of sympathy surged over me for, as I looked on her face and figure, I realized that the effort must have cost her untold anguish.

Her words were: "WHAT-D'YOU-WANT?"

What did I want? No! no! Sweet Seventeen must never know the

fascination of those curving red lips—not from me, at any rate. But what did I want? That was the question.

I doffed my topi; and those who know will agree with me that a topi does not lend grace to any form of salutation. Nevertheless I can aver, without fear of contradiction, that, on this occasion, my management of my solar topi would have done credit to Sir Walter Raleigh in the presence of Queen Elizabeth.

"Good morning" I said, with a prodigious, sweeping bow and a sunny smile.

Sweet Seventeen straightened up and emitted a discreet little cough, a fairy cough. Her thoughts were running thus (they were easy to read)—"O-o-o-ooh my! this guy isn't a tarry sailorman at all: he's a soldier, and just out of a hot bath too." What she actually said was: "Good morning—yess?" and smiled. Ah! the double row of strong, regular teeth, white as snow, iridescent as the finest pearls.

"*Good* morning." (I was very careful not to replace my topi on my head.) "I have called for letters."

"Yess? Your name, sir, pleese? No sir, I'm sorry; but let me make certain—I'll look through them again. Oh, no sir—no trrouble at all."

Then she gave me a form on which to write my next address. She even allowed me to write with her own fountain pen: nay, she insisted I should do so, and this she did with all the firmness which her gentle heart was capable of exercising.

"Perhaps you were expecting letters?" she enquired in a voice compounded of an indescribable mixture of sweetness and reserve.

Obviously I was expecting letters—but I made the most of it: I looked into her eyes, I put on a mask of mystery and sorrow, and I answered in a whisper: "No. *One* letter . . . and it is not here."

S. S. took it badly. Her lips trembled. Her big eyes clouded over and were cast down. She sighed. "I, allzo, expected a letter—but not the sorrt of letter I have just received."

The demon inside the clock said "Tong!" Fifteen minutes had passed away.

I bowed: a low, grave bow. Sweet Seventeen managed to summon up a brave little smile before I reached the doorway. Georgina met me half-way down the steps. "Good gracious!" she exclaimed: "are you still alive?" "Curse the colossal stupidity, the lotus-eating lethargy, the inimitable inefficiency, of the Indian post-office!" I stormed.

As the car pulled out, Sweet Seventeen waved to me from an upper window. However, Georgina, whose attention was fully occupied in steering through the crowded thoroughfare, found opportunity to remark that, on arrival at our next poste restante, I would remain in the car while she did the business.

I daresay she was right.

There are good wives, bad wives and indifferent wives, but wonderful wives are uncommon. Personally, I have only met a single specimen of the wonderful variety. You may have been more fortunate but—as I say—the wonderful wife is the exception. However, in the first half of last century there lived in Madras a paragon of a wife; and all she was in mind, body and soul has been recounted, in verse, on a marble plaque in St. Mary's Church, Fort St. George. Short of quoting this verse verbatim, it is impossible adequately to convey the angelic qualities of this lamented lady.

The plaque was put up by her sorrowing husband at the close of two months of married bliss.

The average married man desirous of ascertaining what are a wife's possibilities should go to Madras and read that verse.

Georgina studied the encomium with much interest and attention, and remarked: "H'm—well—I had no idea I was quite as perfect as all that."

St. Mary's Church is scrupulously clean, in an excellent state of repair, and reverently tended. It contains some fine old stands of colours, and many monuments and memorials of various kinds to the glory of God, and in commemoration of the departed, distinguished and otherwise. Some of the sculpture is, from an artistic standpoint, very good; and some of it is very bad, quite apart from the Victorian urns and weeping willows.

As a spectacle, Fort St. George is simply charming and—so far as we were concerned—unique. It is so unmistakably English—or, rather, early Colonial English: Bridgetown, Barbadoes, Richmond, Va., or Boston, Mass. There is as much difference between the Madras docks and Fort St. George as there is between the Broomielaw and Edinburgh Castle. Let us hope that, when India is handed over to the Indians, Fort St. George will be excluded. An English guard should be installed permanently in the fort, and a notice nailed above the main gateway: "Trespassers will be shot on sight."

The menu for tiffin included oysters. In spite of Georgina's vehement protests, I succumbed to the temptation. The oysters were not fresh, and I paid the penalty for my foolhardiness and obstinacy. There is no doubt I had a lucky escape from something worse, for the penalty, though of short duration, was painfully sharp. We had planned to visit St. Thomas' Mount after tiffin, but my oyster indisposition interfered. Georgina was disappointed, and it is therefore greatly to her credit that she only said "I told you so" once.

Those who know a little about India cannot fail to be surprised at the high degree of immunity possessed by many people who habitually eat large quantities of such things as salads, strawberries and oysters, uncooked. By all the laws of hygiene, such comestibles ought to produce frequent and serious outbreaks of disease; but an absence of ill-effects is the rule, and not the exception. No doubt several washings in weak "Condy's" diminish

the dangers, but they certainly cannot reduce the risks to the safety level. Maybe it is better to run the gauntlet of gastro-enteritic infection than to bear the burdens of vitamin-deficiency: better to be killed quickly than die slowly: better for you, and ever so much better for your friends.

Still—many moons will wax and wane ere I touch an oyster again.

On March 11 we left Madras and headed due south for Trichinopoly. A run of eleven miles over an excellent road brought us to St. Thomas' Mount.

The entry to this old cantonment creates a good impression. The vista is attractive, and the whole place looks clean, tidy, and in good order. It so happens that the "show pieces" and the greenery are on the main road, while the bazaars, abattoirs, and similar unsavoury adjuncts are tucked away, safely out of sight, to the east.

Is it not a fact that, in the military life, far too little heed is paid to the ordinary decencies and amenities of social existence? After all, the twentieth century is now well advanced; and, with regard to certain customs and usages, we are not French or Belgian in outlook, and never will be, despite all the reforming zeal of the Royal Engineers. And so it comes about that, if your bungalow is situated anywhere near the lines, you—and your wife—are compelled daily to pass within a few feet of urinals, latrines, wash-houses, etc., in and out of which is a constant stream of men who are fastening or unfastening their clothing—that is, when they are wearing anything more than a towel. It is not pleasant for the men, and it is not edifying for you—or for your wife. It is said of the above annexes, firstly, that they must be sited to the flanks of the barracks; and secondly, that they must be on, or very near, the roads: hence the trouble. Neither of these statements is worth twopence; but if the sappers were told that such annexes must not be erected within 100 yards of any roadway, the offence would cease; the sappers have the brains not only to carry out such an instruction, but to find the money for it, too.

Further—what civilian community would tolerate a filthy, malodorous Croly cart traffic along its main streets by day as well as by night?

Viewed from the main road, at any rate, St. Thomas' Mount is free of public nuisances. This is at it should be because, if cleanliness is next to Godliness, then St. Thomas' Mount ought to be wondrous neat and clean. To begin with, it is the reputed place of martyrdom of the evangelist, St. Thomas, and the actual spot is supposed to be the summit of a granite rock which rises abruptly from the ground to a height of 220 feet above sea-level.

A Portuguese expedition landed here in 1547 and found the original church, or hermitage, in ruins, and the site in occupation of a fakir. It is probable that the building was destroyed in the early wars between the Mahommedans and the Hindu leader Vijayanagar.

In the process of excavating the foundations of this building, these Portuguese dug up the celebrated Mount Cross—a slab of stone bearing in relief a cross, and a bird (dove ?) with wings expanded, symbolical of the Holy Ghost. This sacred carving is considered to date from the eighth century. The Church of the Expectation of the Blessed Virgin was erected on the foundations of the original church, and the Mount Cross was built into the back of the altar.

On the plain below, the Church of the Presentation of the Blessed Virgin was built by the boatmen of Madras in 1764, and near it stands an exceptionally fine British garrison church.

In former times St. Thomas' Mount was the scene of much strife and bloodshed, and especially during the Franco-British wars of the Carnatic. A particularly fierce affray took place here on February 7, 1759. It is one of our oldest cantonments, and used to be the headquarters of the Madras Artillery. The artillery mess was an unusually handsome and commodious building of its type. However, like most of the cantonments in South India, the military glory of St. Thomas' Mount is now a thing of the dim and distant past.

The subject of fighting and mention of the Portuguese remind me of a remarkable statement made by Mr. Hilaire Belloc in his "Cruise of the Nona." He says that one of the most arresting opinions he has ever heard was that of Cardinal Manning's, to the effect that all wars have a religious basis. Without any qualification, the foundation of war is theology.

This opinion finds striking illustration in Mr. E. F. Benson's "Sir Francis Drake"; and herein is also explained the presence of the Portuguese in India. The interested reader should refer to Chapter II of Mr. Benson's book. The following are a few extracts :—

> Spain was then at the height of her power, which overshadowed Europe to an extent unknown since the Roman Empire towered over it. She did not maintain her grip on the world by the mere material strength of her army, never yet seriously tested, or of her hitherto unchallenged navy, for at her back was the whole power of the Papacy. Spain was easily the most valuable of the Pope's (Pius V: later Sixtus V) spiritual kingdoms, and though the Church of the Vicar of Christ was in Rome, the vicarage, so to speak, was in Madrid. . . . Papal bulls and briefs had partitioned between Spain and Portugal the whole of the New World already discovered, with inalienable rights over its gold and its spices, its coasts and continents, and by way of bonus had assigned jointly to these two nations the seas of the entire world. The Mediterranean, the Atlantic, the Pacific, the Indian Oceans, were all private lakes on the estates of these fortunate countries. On land they had their separate spheres; a fine big map was

> spread before Holy Father, and to Portugal he devised the East Indies, Brazil, and the whole of Africa south of the Canaries: the rest of the New World and the sovereignty of any future extension of it was declared to be the property of good King Philip and his heirs for ever. So also was the crown and kingdom of England when he had conquered it by the great invincible Armada, whose object . . . was "to serve God, and to return into His church a great many of contrite souls that are oppressed by the heretics." God's glory was to be served by the death under the lash and the torture of all those heretics over the age of seven. Those younger were to be branded with an L (Lutheran) on their foreheads and kept as slaves . . . "on the authority of God and the fullness of Apostolic power."

There! It would be impossible to find stronger support for Cardinal Manning's opinion than this. But it makes one rub one's eyes to see the reckless way in which His Holiness flourished his fiery cross in what was a veritable powder magazine. Had he and his advisers no inkling of the characters of the Protestant Queen Elizabeth and her captains Drake, Frobisher and Hawkins? "That was nearly four hundred years ago," you say. Nevertheless, Mr. Benson draws a parallel between the defeat of the Spanish Armada in 1587 and the downfall of Germany in 1918.

As the day wore on it became uncomfortably hot. The country was monotonously dull—for the most part flat and rocky scrub-covered plain with here and there small clumps of palms.

Chingleput, thirty-seven miles from Madras, guards the northern bridgehead over the Palar River. This is another place which, in olden times, was the scene of constant fighting. Here are the remains of an ancient Hindu fort which must have been well-nigh impregnable, for on three sides it was bounded by a lake and extensive swamps and on the fourth it was skilfully and strongly fortified. Later on it became a British camp for French prisoners of war.

By paying too much attention to a sketchy route sheet and too little to the map, we over-ran a left-handed fork leading to Pondicherry. This was annoying, as we were keen on visiting the French settlement; but the mistake was not discovered until it was too late to remedy, and we were cheered on discovering that the direct southerly route reduced the day's run from 230 to 200 miles. This route, however, is impossible in rainy weather, for a few miles beyond the half-way house—Villupuram, 100 miles from Madras—two long causeways have to be traversed over the Panniyar River and one of its branches. When we crossed, a breach in one of these causeways was under repair, and we were thankful for the help of a mob of yelling coolies who pushed and pulled our heavily-laden car through the deep, dry sand.

(*To be continued.*)

A SHELTER-PIECE FOR THE USE OF THE BRITISH SOLDIER.

By Colonel Sir WILLIAM H. HORROCKS, K.C.M.G., C.B.

[This paper was written in 1913. The shelter-piece was approved for trial by the Chief of the Imperial General Staff (Sir John French), but owing to the outbreak of war in 1914 no further action was taken. As the protection of the soldier during mobile warfare is again under consideration, it is thought that the suggestions contained in the paper should be placed on record.]

The official shelter, using the term in its widest sense, provided for the soldier, consists of a greatcoat carried by the man and a waterproof sheet carried in the baggage section of the train. In special circumstances a blanket for each man may also be carried in the baggage section. During concentration of the troops, additional shelter would probably be obtained by billeting the men. Soldiers are supposed to obtain better sleep in billets

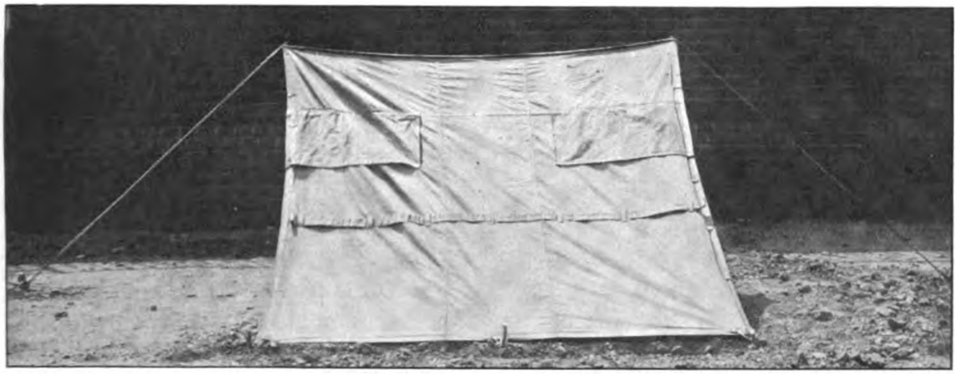

Fig. 1.—Shelter-piece as a tent. Side view showing one piece.

than in bivouacs; but billets expose the troops to a greater chance of infection from the civil population and, as a rule, additional sanitary conveniences have to be provided in circumstances which make adequate supervision somewhat difficult. Also, it seems likely that it will be impossible to provide billets for many of the men of a large force without unduly splitting up the various units, and, when in close proximity to the enemy, tactical considerations will necessitate a large portion of the force bivouacking in the open. In these circumstances, the question of shelter becomes important, especially if the concentration has taken place rapidly and there has not been time for the reservists to become fit. The soldiers

of most of the first-class Powers carry a shelter-tent piece as well as a greatcoat, but this entails an addition of at least three pounds to the weight already carried by the soldier, and for this reason many commanders object to the provision of shelter-tents for British troops.

Impressed with the importance of providing some means of additional shelter, I have designed a shelter-piece for use as a shower-proof coat and, in combination with other pieces, as a shelter-tent.

The shelter-piece is made of khaki drill treated by a special process which renders the material quite shower-proof. Each piece weighs three pounds, measures 5 feet 6 inches by 5 feet 5 inches, and has five button holes and five double buttons on three sides, the fourth side having three loops which are placed round the tent pegs. It has also two apertures 11½ inches in length, covered by flaps which can be fastened down by two buttons. At each end of one side, which forms the ridge of the tent, there are two small circular apertures through which the tops of the tent poles are passed. A narrow belt runs transversely across the sheet about three feet from the side forming the ridge of the tent (see fig. 1).

Use as a Shelter-Tent.

Each soldier is supposed to carry :—

	Weight
1 Shelter-piece	3 lb.
1 Pole	15 oz.
2 Pegs	1½ oz.
1 Guy-rope	¾ oz.
Total weight	4 lb. 1¼ oz.

The pole is made of wood, has two joints and is narrowed at one end, which passes through the apertures in the ridge side of the shelter-pieces.

Method of Carriage of Shelter-piece, etc.—When the Webb equipment and valise, containing the greatcoat, are worn, the shelter-piece is carried folded round the top and sides of the valise, being held in place by the straps crossing the valise. The jointed pole is placed under the valise, and the pegs and guy-rope are carried in the valise.

Formation of the Shelter-tent.—In order to form a tent, the pieces may be combined in various ways :—

(1) Four pieces may be used; three form the tent, which has one end open, the fourth being placed on the ground should a waterproof sheet be not available (see fig. 2).

The shelter-tent arranged in this manner has been exposed to severe storms of rain, a dummy, clad in a khaki jacket and weighing 150 pounds, being placed on the shelter-piece laid on the ground. There has been no gain in weight of the pieces or khaki jacket. The ground-piece feels cold, but does not transmit moisture. In severe weather, the four sides of the tent may be shut in, but in these circumstances the apex of the triangle on the leeward side should be left open and the flaps propped up

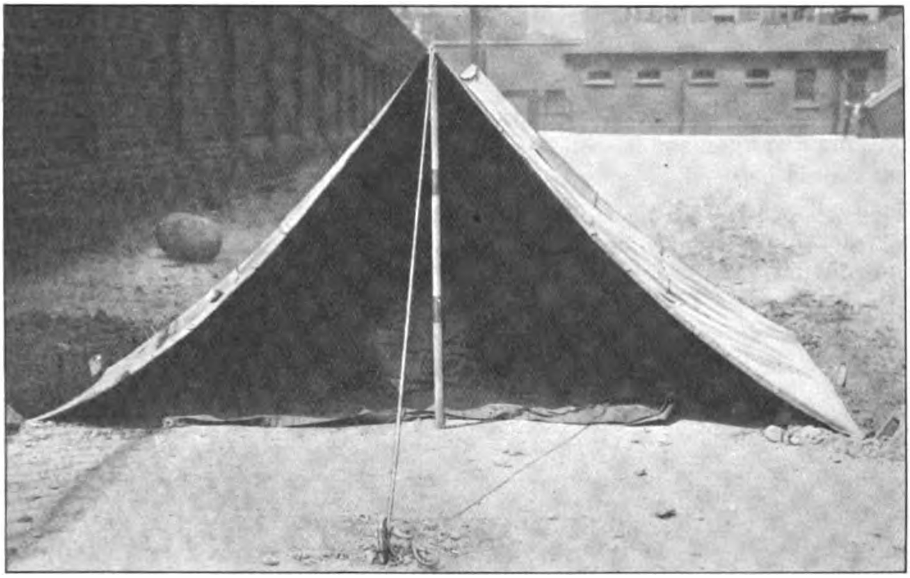

Fig. 2.—Four pieces used to form a tent and ground sheet. One side of the tent open.

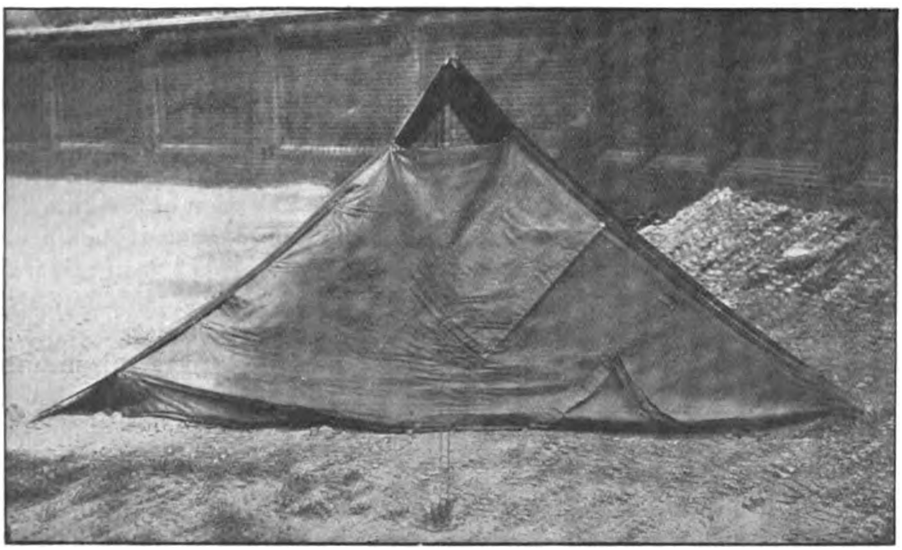

Fig. 3 —Shelter-tent with apex of triangle open to allow through ventilation when four pieces are used to form the tent.

with pieces of stick. A good current of air will then be obtained through the tent (see fig. 3).

(2) Four sheets are employed; two form the roof and back and two fill in one side; the remaining sides are left open. The area protected may be prolonged indefinitely by adding sheets to the roof and back.

This arrangement is well adapted for obtaining protection from the sun, and should be used in fine dry weather as the men sleep practically in the open. Except in *very* cold, wet weather, this method of obtaining shelter is preferable to the tent formation, as the men are well protected from rain and ventilation is much better (see fig. 4).

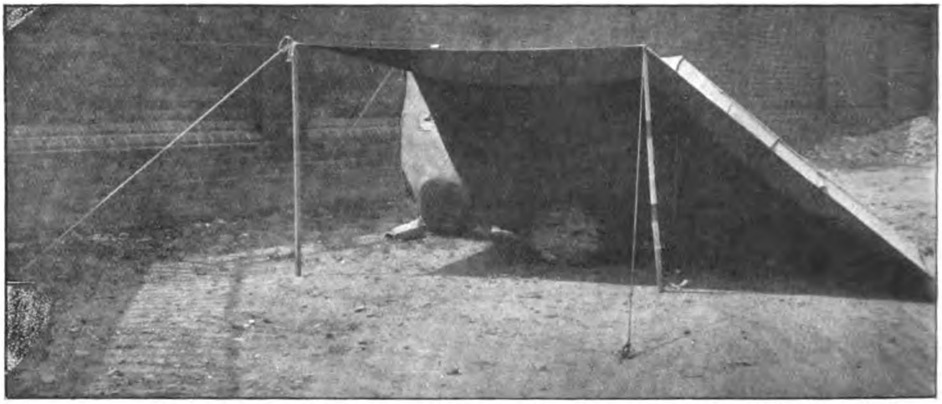

Fig. 4.—Four pieces used to form the tent, as a shelter from the sun-rays and for use in fine dry weather.

Use as a Shower-proof Coat.

In order to facilitate the use of the shelter-piece as a coat, two apertures covered with flaps are provided. When on the march and protection from rain is required, the two straps crossing the valise are loosened and the shelter-piece is withdrawn without disturbing any portion of the kit. The arms are passed through the apertures in the piece, the belt is then drawn up under the valise, passed between the ammunition pouches on the waist belt of the Webb equipment and tied off in front. The portion of the shelter-piece round the neck is folded twice and the buttons are then fastened down the front. When the shelter-piece is worn in this manner, the soldier has complete freedom of movement for his arms and can use his rifle if required to do so (see fig. 5).

General Remarks.

The addition of 4 pounds 1¼ ounces to the load already carried by the soldier is to be deprecated. The shelter-piece might be carried in the baggage section of the train in place of the waterproof sheet now allowed,

but in this case the soldier would have to depend on his greatcoat for protection from rain, as it is unlikely that the troops, while on the march, would be able to obtain their shelter-pieces from the train. Now the greatcoat absorbs moisture rapidly and gains considerably in weight, also, when

Fig. 5.—Shelter-piece as a shower-proof coat.

saturated with water it is not a desirable garment in which to sleep at night. If the shelter-piece is worn as a coat, it does not absorb moisture and the soldier arrives at the end of the march with a dry greatcoat which he can put on just at the time when his temperature is falling and he requires additional covering to prevent a chill.

There are two ways in which the increase of the load, necessitated by the carriage of the shelter-piece on the person of the soldier, may be obviated.

Firstly.—The valise might be discarded. This portion of the equipment is the least useful to the soldier, as it can serve no other purpose than a

FIG. 6.—British-warm coat, new canteen, shelter-piece, and iron ration in carrier.

"carrier" and weighs 1 pound 10 ounces. Instead of a long overcoat a "British-warm" coat with large inside pockets might be worn; the pegs, guy-rope, towel and necessaries would be carried in these pockets. The change in the overcoat would diminish the weight carried by 1 pound 8 ounces. By these suggestions a total saving of 3 pounds 2 ounces would

be obtained, so that a shelter-piece, with all its advantages, could be carried by the addition of 1 pound to the present load.

If these suggestions were adopted, the folded pole might be placed inside or below the folded "British-warm" coat, which would be carried in a "strap-carrier" like that worn by the Territorial Force (see fig. 6).

FIG. 7.—Warm jacket, towel, necessaries, tent pegs and guy-rope carried in haversack, and new mess-tin with shelter-piece over it.

It is possible that the increase of 1 pound in the weight carried might be obviated by making the shelter-piece of lighter material, so that it would weigh only 2 pounds, but it is doubtful whether such a thin material would prove serviceable for any length of time.

Secondly.—Having the shelter-piece for wear as a rain-proof coat, all the soldier really requires is a light warm jacket to put on at the end of the march or for wear at night. A jacket similar to the Icelandic jacket of the Norwegians would probably suffice for this purpose, and could be carried in a small haversack, containing also the towel, necessaries, pegs and guy-rope (see fig. 7).

Weight of jacket	2 lb. 4 oz.
,, haversack	11 oz.
Total weight	2 lb. 15 oz.

If to this weight be added that of the shelter-piece and accessories, i.e., 4 pounds 1¼ ounces, the total weight becomes 7 pounds ¼ ounce. Now the greatcoat weighs 6 pounds 8 ounces and the valise in which it is carried 1 pound 10 ounces, a total weight of 8 pounds 2 ounces. It will be seen, therefore, that in this scheme the soldier obtains a combined showerproof coat and shelter-piece, also a warm jacket to wear at night, and the total weight will be 1 pound 2 ounces less than the soldier carries at the present time.

THE TREATMENT OF DIABETES.[1]

By Major A. G. BIGGAM, O.B.E.,
Royal Army Medical Corps.

In opening a discussion on the treatment of diabetes it might be well to begin by pointing out that no new drug of any real value in the treatment of diabetes has been discovered since 1922 when insulin was introduced; there have, however, been almost hundreds of quack remedies put on the market, which, owing to their skilful advertisement and ease of administration, are still prescribed by some doctors to their diabetic patients. The benefit claimed to have resulted from the use of such drugs is usually due to the restricted diet which is carried out concurrently with the administration of these so-called oral diabetic cures, for if care be taken to see that the diet is kept constant before commencing this treatment and during its course no change in the patient's condition will be observed to occur.

Synthalin, a German preparation introduced in 1926, and *neosynthalin* in 1930, certainly bring about a reduction in the glycosuria, according to certain authorities by poisoning the liver cells and so diminishing the endogenous production of sugar by that organ; these preparations can be given by the mouth, but local gastro-intestinal toxic symptoms, nausea, vomiting and diarrhœa very frequently result from their administration when given in large doses, so if used at all synthalin treatment should be reserved for the mildest cases only.

Glukhorment (of Von Noorden) is a dried pancreatic extract with small amounts of synthalin added; any effect it has appears to be due to the synthalin present in the preparation. *Pankreasmellin* and panteric tablets are other products made from the pancreas; it is doubtful if much effect can be obtained from their use.

Treatment of Diabetes by Diet or Diet and Insulin.

The treatment of a diabetic depends very largely on the severity of the case, that is on the extent of damage of the pancreas, and the amount of endogenous insulin still available. Where the case is a slight one, diet alone will usually be sufficient to control the excess of sugar and ketone bodies in the blood, the patient regaining health and strength when put on a suitably restricted diet without the addition of insulin. This is the method one adopts when such a case occurs in a poor patient admitted to Kasr-el-Aini hospital; but when the expense of insulin is not a consideration,

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[1] Paper read at the Annual Congress of the Egyptian Medical Association in April, 1932, to open the discussion on the treatment of diabetes.

even mild cases do better on a more generous diet balanced with small doses of insulin.

Where the pancreatic damage is extensive, or in the case of a child where restricted diet is undesirable owing to the importance of not hindering growth, the administration of insulin in addition to dietetic control is essential for the patient's well-being; no attempt should, however, be made to over-fatten diabetic patients, as they usually do better when kept slightly underweight.

If blood-sugar estimations can be carried out the severity of the case can usually be quickly determined and a suitable treatment arranged, but where this is not possible one can usually find out without much difficulty whether a patient can thrive or not without insulin by putting him on a diet of sufficient caloric value to enable him to carry on his usual occupation, say somewhere about 1,500 to 2,000 calories if doing light work, the carbohydrates, proteins and fats being given somewhere in the proportion of carbohydrate 1 : protein 1·5 : fat 3, one gramme of protein being given for each kilo of body-weight; the amounts of carbohydrate and fat may, however, require modification, for if ketone bodies appear in the urine, either the fats must be diminished or the carbohydrates increased or both changes may be necessary in order to get rid of the ketosis. The carbohydrates given during this trial should be almost entirely in the form of vegetables low in sugar value so as to obtain the necessary bulk in the food. The patient is kept on this low diet for a week, and if his urine is sugar and acetone free at the end of that time this diet alone should keep him well. If, on the other hand, at the end of the week of restricted diet he still shows sugar in considerable quantities the case is not likely to prove satisfactory on diet alone and insulin treatment should be instituted.

Where insulin is necessary the patient can be fed on all sorts of carbohydrate, protein and fat combinations and when adequate doses of insulin are given with good results, but we may for convenience divide the treatments into three groups:—

(1) *Low carbohydrate*, 30 to 50 grammes, and moderate protein, with much fat to make up the necessary calories, giving only little insulin; this diet is unsatisfactory to the patient as it is very different to what he is accustomed to take and so is not usually liked by him. Very rarely found satisfactory.

(2) *Moderately high carbohydrate*, 100 to 150 grammes, and two doses of insulin, morning and evening, sufficient insulin being given to balance the carbohydrates; the correct dose of insulin is an individual matter to be found out in every case; as regards meat, other proteins, and fats, the patient on this moderately high carbohydrate diet can usually be permitted to eat as much of these as he desires. This method of treatment is usually found satisfactory, the patient is not likely to develop ketosis and coma, he keeps free from infections and his general health is better than when on a very restricted carbohydrate diet.

(3) *High carbohydrate diet,* 150 to 300 grammes per day ; this is equal to the carbohydrates of a normal diet. If the total calories in proteins and fats are kept very low, then such a diet requires very little more insulin than on the diet given under (2); otherwise much more insulin is needed and greater difficulty is experienced in keeping the patient free from perpetual glycosuria and hyperglycæmia on the one hand and hypoglycæmia on the other; another disadvantage is that three injections of insulin a day are often found to be necessary with this diet. Where a diet very poor in fat is prescribed great difficulty is experienced in its preparation from the cooking point of view; furthermore, patients usually complain greatly of the very limited allowance of fats when put on such a diet. It is important to remember that *cutting down the fats alone will diminish the demand for insulin,* so that when making a reduction in the fats of a diet with a view to increasing the carbohydrates, if high doses of insulin are being used, one must either cut the fats and increase the carbohydrates at the same time, or temporarily reduce the insulin with the reduction of fats until the patient has been put on the increased carbohydrates.

What is the Effect of Hyperglycæmia in Insulin-treated Patients? We all know that patients with excess of sugar in the tissues and blood can feel and keep very fit when given enough insulin to burn sufficient food for their metabolic needs ; but here an interesting point arises : are these people likely to develop the same complications as long-standing uncontrolled diabetics, such as arterial degeneration in the legs with gangrene, and in the eyes with retinitis, or are these *terrible* complications of untreated severe diabetics due to under-nourishment of the arteries, etc., and not directly the result of hyperglycæmia? We don't yet know, so we must go on the principle of trying to control hyperglycæmia as an unnatural occurrence and so possibly harmful.

Treatment of Diabetic Coma.

We all know that diabetic coma is brought about by the absence of sufficient insulin to burn enough glucose for the complete destruction of the fats, this allows the products of incomplete katabolism, ketone bodies, to accumulate in the system; but we should not forget that not infrequently coma is precipitated by the presence of some toxæmic or septic condition in the body, and so in cases when coma is present or threatened all sources of toxæmia should be searched for and if possible at once removed.

The treatment of diabetic coma should be divided in the treatment of :—

(1) *The precomatosed stage* when we are warned of the danger of coma by finding the patient drowsy, and by the presence of ketone bodies in the urine in considerable quantities, as shown by the ferric chloride test being strongly positive ; here the patient *can always be rescued by giving enough insulin and carbohydrate,* these burning together to reduce the dangerous ketosis.

(2) *The Profound, well-established and Complete Coma where the Patient cannot always be Rescued by Insulin alone.*—Here the patients are dehydrated from the previous polyuria and vomiting, and as a result their eye tension is low, the heart and circulation collapsed with pulse rapid and feeble, blood-pressure low, kidney functions poor with albuminuria and casts (always present), oliguria or even anuria, and high blood-urea 60 to 150 milligrammes per cent, all symptoms resembling those found in a case of cholera and requiring similar treatment for their relief.

The treatment for such a case of coma can be considered under three headings :—

A.—Treatment of the predisposing cause.

B.—Treatment of the ketosis by plenty of insulin and carbohydrates.

C.—Treatment of the condition of marked dehydration.

As regards A, any gross septic condition present which predisposed the patient to coma, such as an empyema, should be at once dealt with if possible, preferably under a local anæsthetic.

B.—The ketosis should be treated by giving plenty of insulin, perhaps 200 to 300 units in the twenty-four hours balanced by sufficient sugar to bring about complete combustion of the fats and to prevent hypoglycæmia, recollecting that the sugar is quite as important as the insulin in the removal of a severe ketosis.

The most satisfactory way of giving glucose in such severe cases of coma is by the intravenous route, giving glucose and insulin in the proportion of one unit of insulin for each gramme of glucose, using a 10 per cent glucose solution; 500 cubic centimetres of 10 per cent glucose with 50 units of insulin added are therefore run into the vein very slowly, and this is repeated every two hours till the patient recovers from the coma, when 50 grammes of glucose by the mouth and 25 units of insulin subcutaneously are given every three hours till the acetone bodies disappear from the urine, after which the patient can be placed on a suitably balanced diet and insulin.

When blood-sugar estimations are not possible, it is always well to give sufficient glucose to keep some sugar in the urine and so avoid the risk of hypoglycæmia. In the treatment of a case of diabetic coma we should never forget that the administration of large amounts of glucose can do nothing but good provided sufficient insulin is given to activate this sugar; this liberal supply of sugar encourages us to use sufficiently generous doses of insulin. Cases of diabetic coma should, if possible, always be treated in a hospital where blood-sugar estimations can be carried out at frequent intervals. When these facilities are available very large doses of insulin can often be given, and if necessary, repeated frequently without any danger of hypoglycæmia, the patient thus being rapidly brought out of his coma.

C.—Treatment of the dehydration. This is often *almost as important as the treatment with sugar and insulin.* Cases with only moderate

dehydration may be treated for this by giving fluids by the mouth when the patient can swallow, otherwise by the stomach tube, by rectal enema, and by the subcutaneous route. In all very severe cases, however, where the secretion of urine is markedly diminished and a mounting blood-urea indicates the onset of uræmia, the intravenous method is the only satisfactory means of getting sufficient fluid rapidly into the body; the treatment should be very similar to that for a case of cholera, commencing by giving two litres of hypertonic saline 1·2 to 1·8 per cent intravenously, running in this amount in about half an hour; half a litre of seven per cent gum-acacia solution can often be given in addition with considerable advantage. The hypertonic saline and gum-acacia solutions tend to remain in the circulation better than normal saline, and the additional sodium chloride helps to replace that already lost by the polyuria and vomiting. Recently the administration of twenty-five per cent glucose in normal saline solution has been advocated in cases of severe dehydration with threatened uræmia, the results obtained being very satisfactory. The glucose solution drawing fluid from the tissues into the blood-stream improves the general circulation and so increases the flow of blood through the kidneys, thereby assisting in the elimination of waste products by these organs. Two to three minims of adrenaline solution can with advantage be added to the intravenous infusion for its cardiac effect when the patient's condition indicates this.

Editorial.

THE HEALTH OF THE ARMY.

In his Report on the Health of the Army at home and abroad for the year 1931, submitted to the Under-Secretary of State, the Director-General, Army Medical Services, states that the health of the Army was very satisfactory, although influenza was prevalent in the early months of the year and was responsible for an increase in the admission ratio to hospital of 39·3 per 1,000 of the strength, viz., for a ratio 467·7 per 1,000 compared with 428·4 per 1,000 in 1930.

The principal causes of admission to hospital in 1931 were: influenza 8,324 admissions; malaria, 7,191; venereal disease, 5,865; inflammation of tonsils, 5,754; inflammation of areolar tissue, 5,261.

The number of invalids discharged from the Army was 8·19 per 1,000 of strength compared with 9·28 in 1930. The principal causes of invaliding were pulmonary tuberculosis, inflammation of the middle ear, and epilepsy. It is interesting to note that there has been a marked fall in the number of men invalided for inflammation of the middle ear; in 1930 there were 182 men invalided from this cause, but in 1931 only 131. The action taken by the War Office in regard to the examination of recruits for evidence of ear disease is bearing fruit. Invaliding for disordered action of the heart is also decreasing; in 1930, 61 men were discharged for this disability, but in 1931 the number of men was only 19. This improvement may be largely attributed to the physical training tables being now arranged so as to reduce to a minimum the strain on the circulatory system of recruits during their course of physical training.

The principal causes of inefficiency were: gonorrhœa, with 588·68 constantly sick in hospital; influenza; fracture; inflammation of areolar tissue; malaria; inflammation of tonsils; inflammation of bronchi.

A study of Chart III in the Report, giving the monthly admissions to hospital for the most prevalent diseases at home during the years 1930 and 1931, shows only a slight wave of admissions for influenza in the months of March, April and May, 1930. In 1930, however, the admissions began again in December, and rapidly rose to a peak, with 2,349 admissions, in February, 1931. This was followed by a marked fall in March and April, and the disease disappeared in May.

The curve for tonsillitis shows a wave of admissions in both 1930 and

1931 extending from January to June, with the peak in March. Although the admissions were some 200 more in 1931 than in 1930 there was still a considerable reduction compared with the average for the preceding five years.

The chart showing the admissions to hospital for the most prevalent diseases abroad, except India, is remarkable in 1931 for the large wave of admissions for sandfly fever extending from May to November, with a peak in August of 279 admissions. There was a similar wave of admissions in 1930, but the peak of 100 admissions was in September. The constant high level of admissions for venereal diseases is also very evident and most marked during the summer months. The admissions for digestive diseases show a similar curve at about the same level.

The number of working days lost to the Army at home by the common diseases was 372,526 in 1930, and 391,353 in 1931. Of these, diseases of the digestive system, excluding tonsillitis, accounted for 81,125 days, tonsillitis for 31,054 days, venereal diseases for 62,181 days, and influenza for 60,079 days. Abroad, excluding India, venereal diseases caused a loss of 101,977 days, and diseases of the digestive system 27,682 days. We have frequently commented on this loss to the State and urged the necessity for further research in regard to these diseases.

The wave of admissions for sandfly fever abroad (excluding India) was apparently mainly due to an outbreak in Egypt. There was a sharp epidemic in Cairo, the number of cases rising from 255 in 1930 to 767 in 1931. The majority of the cases occurred between July and October, when a sustained high temperature and increased humidity are stated to have favoured the development of sand flies. In Cairo the majority of the troops are accommodated in old barracks, the walls of which form a favourable nidus for sand flies. In the better barracks of the Helmieh quarter there were fewer cases than elsewhere in Cairo. At Abbassia the benefit of newer barracks is said to have been nullified by the dumping of rubbish in the desert within fifty yards of the barracks. There were fewer cases of sandfly fever in Malta than in 1930, and the majority occurred in August and September. Floriana, as usual, had the greatest number of cases; the barracks are close to the old bastions and surrounded by an infected civil population. At Imtarfa, which is situated in the open country, the attack rate was low. The fly most commonly found at Imtarfa was *P. perniciosus*, while at Floriana *P. papatasii* was most prevalent.

In India there were 2,203 cases of sandfly fever compared with 2,739 in 1930. While India as a whole shows little change over a series of years, there are remarkable variations in individual stations which cannot be entirely explained by the presence of a "salted" or "unsalted" regiment. In the Plains the disease shows a tendency to occur in two waves; the first in April and May and the second in July and August. The incidence of sandfly fever appears to have no direct relation with either rainfall or mean relative humidity, but a mean temperature of over 70°F. and under 90°F.

at 8 a.m. is usually associated with an increased incidence. No really effective methods of prevention have yet been devised. Repellents are of little value owing to their evanescent effect, and the necessity of employing a close mesh renders nets too airless for use in a tropical climate.

The admissions for dengue in the Army as a whole show little change, but in India there was an increase due to a sharp outbreak in Calcutta. Non-epidemic dengue is not easy to diagnose and, as recorded in 1930, there is often much confusion between this disease and sandfly fever when both occur about the same time. Many second attacks of sandfly fever frequently reported in Indian stations are probably cases of dengue.

There were 202 cases of pyrexia of uncertain origin in 1931, compared with 115 in 1930. A special case sheet was introduced in 1929 for cases in which the pyrexia lasted seven days and over, and these, together with the cases of shorter duration recorded on the Hospital Record Card and for Indian troops on the ordinary case sheet, have been analysed and classified into "long" and "short" fevers. Among the British troops there were 50 "long" fevers and 158 "short," and among Indian troops 20 "long" and 20 "short." The "short" fevers commonly lasted two to three days; they presented no special symptoms beyond those associated with pyrexia. The 70 "long" fevers were classified by two independent observers according to the diseases they most closely resembled—45 and 40 were placed in the enteric group, 6 and 11 in the sandfly dengue group, 0 and 9 recorded as malaria, and 19 and 10 as no particular disease. Classified according to symptoms 31·4 per cent had abdominal symptoms, 7·1 per cent had enlarged spleen without abdominal symptoms, 14 per cent catarrhal symptoms, 24·3 per cent had rigors and/or generalized pains, and 22·9 per cent showed little beyond headache. Of the abdominal cases 27 per cent showed a 100 per cent rise of agglutinins contrasted with 18 per cent in the other groups. All possible clinical and laboratory tests were carried out with negative results. All that could be said as a result of the enquiry was that a certain proportion of the cases of fever are probably of intestinal origin. Evidently the term pyrexia of uncertain origin must be employed for the present, otherwise statistical errors will be serious.

During 1931 there was a slight diminution in the admissions for enteric fever. Of the total admissions 6 were from home commands, 183 were in India and 23 in Egypt; 70 were typhoid, 635 paratyphoid, and 115 were returned as belonging to the enteric group.

It is stated that in India, although there has been a decreased incidence among British troops, there has been a slight recrudescence among Indian troops. This has occurred in spite of two doses (half cubic centimetre and one cubic centimetre) of vaccine being administered at intervals of eighteen months. No case is diagnosed typhoid or paratyphoid A, B, or C, unless the specific organism has been isolated. Of the 403 cases occurring in British and Indian troops, 254 were diagnosed by the isolation of the specific organism. The remaining cases were labelled enteric group. Of

the diagnosed cases 80 per cent were diagnosed by blood-culture; 25 per cent would have been diagnosed by fæces culture alone, and 7·5 by urine culture alone. When a positive blood-culture has been obtained, the fæces are not cultured until convalescence. In nine cases the specific organism was recovered long after clinical convalescence had been established. The few cases in which *B. typhosus* was found in the urine is noteworthy; it seems fairly certain that only a small proportion of the enteric cases in India excrete the specific organism in the urine.

Wilson and Blair's medium gave little help in the examination of fæces, and it is considered doubtful whether the medium had any special advantage over the litmus lactose medium ordinarily in use.

A valuable aid to diagnosis is afforded by the agglutination test, but as was pointed out some time ago, the T A B inoculation introduces a serious complication of this test. Estimations of the "O" as well as the "H" agglutinins have been carried out and the results obtained in (*a*) bacteriologically proved cases, (*b*) enteric group cases, and (*c*) cases ultimately shown not to be enteric group, have been analysed. In the case of the "H" agglutinins there was a diagnostic rise, shown by an increase in agglutinins, pointing to infection with one specific organism, in bacteriologically proved cases, and a similar rise in the enteric group cases. In the case of the "O" agglutinins, however, similar results were not obtained with the paratyphoid group, as the paratyphoid cases react with the T O emulsion used to a much less degree than cases of infection with *B. typhosus*.

The production of "H" and "O" agglutinins does not run a parallel course, and a table is given which shows the value of carrying out tests for "O" as well as "H" agglutinins. This table also shows the relative inefficiency of the T O emulsion in paratyphoid cases.

A few sporadic cases of enteric fever occur from time to time in India due to infection acquired from contact with an infected civil population. Epidemics as such have ceased to develop among British troops. The number of officers protected by anti-typhoid vaccination in 1931 was 94·58 per cent, and the number of other ranks 98·7 per cent.

The admissions for dysentery in 1931 were 1,698, a ratio of 9·4 per 1,000 compared with 7·6 for 1930, and 6·2 for the period 1926-30. In India there were 1,593 admissions, a ratio of 28·5 per 100, compared with 22·8 in 1930. There was a definite increase in the number of cases, more than can be accounted for by the drop in the figures for diarrhœa and colitis; 64 per cent were bacillary, 11·9 per cent protozoal and 24 per cent were diagnosed clinically. Most of the bacillary cases were caused by *B. dysenteriæ* (Flexner); a study of these showed that 22·5 per cent failed to agglutinate with a serum polyvalent for strains V, W, X, Y, Z. A classification for these inagglutinable strains has been elaborated by Major Boyd, and further statistics are now being collected in all the laboratories.

The examination of menials employed as cooks, waiters, water-carriers, bakers and dairymen is being continued. Dysentery bacilli were isolated

from sixty-four menials and cysts of *E. histolytica* from 400 menials. There seems little doubt that the vast majority of dysentery cases are due to infection from cases in the civil population.

There has been a decrease in the number of admissions for venereal disease, the ratio per 1,000 being 32·2 compared with 34·5 in 1930.

A chart is given showing the remarkable decrease in the incidence of venereal diseases that has taken place in recent years. The decrease is most noticeable in the home commands and in Egypt and Malta; in Malaya there has been no decrease on the 1913 figure; in Gibraltar the incidence has remained stationary after a fifty per cent decrease in 1923. In China and Jamaica the incidence is stated to be regrettably high, and in the former command special regulations have been made, as the local conditions make efficient control of the disease very difficult.

During the year 1931 there were numerous scattered cases of cerebrospinal meningitis both in the Army and in the civil population. There were 88 cases among the troops; 83 with 30 deaths occurred at home. Aldershot had the greatest number of cases. It is stated that there was no evidence of case-to-case spread, and it is suggested "that the disease is essentially a naso-pharyngitis and spreads as such, and that invasion of the blood and meninges seems only an occasional complication, or a sideline development. The case mortality was high, thirty-eight per cent. Many of the earlier cases were of a severe toxic type, but the disease never assumed epidemic proportions, and there were not many mild late cases, which being more amenable to treatment lower the general mortality rate. We have published two excellent reports, one on cerebrospinal fever in the Aldershot command, and the other on the outbreak in the Northern command.

Malaria gave rise to an admission ratio of 39·6 per 1,000 compared with 41·3 for 1930, and 44·4 for the period 1926-30. Of the 7,191 total admissions, 6,282 occurred in India, 417 in China, and 239 in Egypt and Palestine. In India, the year 1928 was remarkable for very good climatic conditions, and the admissions for fresh malaria cases were very low. There were consequently very few admissions for malaria relapse cases in 1930, but in the autumn of that year there was a severe outbreak of both benign and malignant tertian malaria. The civil disturbances also necessitated the troops being kept in the plains and frequently moved out of barracks. In 1931 operations had to be carried out in Burma in a most malarious area and under conditions which almost precluded the use of preventive measures. The result was a considerable increase in the incidence of malaria there. It is therefore easy to understand why the incidence of malaria was higher in 1930 and 1931 than in the good year 1928.

An attempt has been made to prove the existence of "missed" cases of malaria; the hospital records of five British regiments were examined. Among the total of 2,688 admissions there were thirty-eight admissions for febrile conditions followed later in the year by an attack of malaria. An

examination of these cases showed that not more than one per cent of the total admissions could be considered as "missed" malaria.

There has been a marked decrease in the number of chronic relapsing cases sent to the Malaria Treatment Centre, Kasauli; this is attributed to the more general use of plasmoquine. It is now accepted that 0·03 gramme of plasmoquine plus 20 grains of quinine daily for twenty-one days will reduce the relapse rate to the neighbourhood of 5 per cent.

Atebrin has been tested in a few cases and a dose of 0·1 gramme three times a day appears to cure an attack of malaria in five to seven days. If this drug proves effective in preventing relapses, it is thought that a short course of atebrin for five to seven days, with a short course of plasmoquine during convalescence, may cure not only the individual attack but the infection.

In the Section of the Report devoted to the Special Department of Hygiene, it is stated that the new uniform, which has been issued to a few units for trial, was devised by Officers of the Directorate of Hygiene, assisted by an Officer from the Royal Army Clothing Depot at Pimlico. The new uniform is considered to be more suitable for the arduous work of manœuvres and fighting. It is admitted that one uniform cannot be devised to meet the dual requirements of peace and war.

The Elliott Mobile Water Sterilizing Plant has been completed; but owing to the cancellation of manœuvres the trials with it were inconclusive. The process by which chloramine is obtained has been altered and a very stable compound is stated to be produced.

A process for the sterilization of water in the regimental water cart by means of chlorine and ammonia has been devised for use under service conditions. Two tablets of ammonium chloride (0·35 grain) and two scoopfuls of chlorosene (thirty per cent S. T. Bleach) are used for the contents of the cart and it is stated that one hour's contact is sufficient to effect sterilization. We shall watch the trial of this new method with great interest, and hope that the difficulties hitherto experienced with the use of chloramines have now been overcome.

In the Pathology Department research work on the preparation of typhoid-paratyphoid vaccine has been continued: the object has been to prepare a vaccine which would stimulate the maximum production of "O" agglutinin on injection. Using a recently isolated strain which showed the presence of well-marked "O" antigen, it has been found that a vaccine sterilized with formalin and preserved with carbolic acid gives the best results. In the human object "O" titres of 1 in 700 have been obtained. It is proposed to manufacture a larger quantity of the vaccine for more extended trials in endemic areas of enteric fever. Up to the present the tests have been confined to the typhoid element of the mixed vaccine.

Investigations have been commenced on the antigenic structure of cholera vibrios obtained from a variety of sources. The diagnosis of cholera has been rendered difficult by the fact that many vibrios obtained from

typical cases of the disease have failed to agglutinate with diagnostic cholera agglutinating serums. Moreover, it has been found that an agglutinable vibrio may on subculture rapidly pass into an inagglutinable phase and this alteration may also occur *in vivo*. Further, the typical cholera vibrio is usually considered to be non-hæmolytic, yet under certain conditions it may become strongly hæmolytic. It is evident, therefore, that complete reliance cannot be placed on these two tests. It is considered that from the point of view of prevention a non-agglutinating hæmolytic vibrio from a suspicious case of cholera should be regarded as a potential source of danger.

Clinical and other Notes.

TWO MISLEADING CASES.

By Major G. MOULSON,
Royal Army Medical Corps.

(*Continued from p.* 222).

Case 2.—Pyogenic Abscess of the Kidney.

Driver B., Royal Army Service Corps, aged 19. Service one year.

This patient was admitted to the Medical Division of the Royal Herbert Hospital on the morning of November 24, 1931, with a history of having reported for seven consecutive days at the Medical Inspection Room complaining of abdominal pains and having vomited once. Nothing bearing on the case could be elicited either from his past or his family history.

On admission the temperature was 100·4° F., pulse 108. He complained of pain and tenderness on pressure over McBurney's point. The bowels were constipated; the tongue was slightly furred. No rigidity of the abdomen could be detected and no hyperæsthesia was present. Rectal examination was negative. The urine was normal and contained no deposit. The physician in charge of the case diagnosed appendicitis and called in surgical assistance. An obstructed appendix was regarded as the most probable explanation and laparotomy by a right paramedian incision was performed the same afternoon. A thickened, kinked and adherent appendix, showing slightly injected vessels, was removed, the abdomen closed and the patient returned to bed. The wound healed by first intention. On the second morning after operation a severe iodine rash was noted; the bowels were open. Convalescence appeared normal except for the presence of a continued pyrexia, associated with a slight cough. On December 6, 1931, the fourteenth day after operation, the temperature was still running between 100° to 101° F.; pulse 80 to 90. The wound was well healed. No abdominal discomfort was complained of and the bowels were opened regularly. Examination of the chest suggested slight dullness at the right base, but no adventitious sounds could be heard. X-ray of the chest was negative. A culture of the urine was sterile; it contained no blood, pus or debris. Total red cell count was 5,150,000, total white cell count 17,000. Hæmoglobin index was 76 per cent. The differential count indicated a slight relative increase in polymorphonuclear leucocytes. On December 12, it was noted: "Patient looks ill with a complexion of a pale earthy tint. Pyrexia continues, it has become more irregular, varying from 99·8° F. in the morning to 103·8° F. in the evening, and being of the

'Alpine peak' type. The patient still complains of a short cough, but no sputum is produced even after administration of an expectorant mixture." No abnormal physical signs could be discovered. The blood was sterile on culture and Widal's test for enteric group was negative.

On December 14, the Wassermann reaction was pronounced negative, the patient stated he felt better and the temperature at its maximum was lower (99·4° F).

December 18: Remittent temperature, high in the mornings, continues. Differential and total white cell counts repeated every other day showed a relative decrease in polymorphonuclears with a corresponding increase in small and large lymphocytes. The total white cell count was gradually diminishing. On this date it was noted that some enlarged lymph glands were present in the neck, axillæ and groins. At times the patient was subject to profuse sweats. There were urticarial spots on the abdomen. The urine was still normal.

December 25: The cerebrospinal fluid was examined and found normal as to cell count and composition.

Fæces were examined and reported negative for tuberculosis. X-ray of abdomen showed no evidence of a foreign body resulting from operation. No enlargement of the liver could be detected, nor any collection of fluid in chest.

December 29: The patient first admitted that for the preceding seven days he had been conscious of some slight discomfort in the right loin when subjected to deep pressure. On palpation there appeared to be slight guarding of the overlying muscles. Suspicion could at last be attached somewhere and was eagerly followed up the following day by an intravenous pyelography, using abrodil, with the valuable results shown by tracings from the actual skiagrams, reproduced in fig. 1.

December 31: Cystoscopy with retrograde catheterization of the right ureter was carried out. No abnormality was noted round the right ureteric orifice and no tuberculous ulceration could be seen. Twenty per cent sodium iodide solution was injected into the pelvis of the right kidney after passage of the ureteric catheter, and seventeen cubic centimetres of this solution were introduced before the patient complained of any discomfort. The radiogram showed the shadow reproduced by the exact tracing, which is exhibited in fig. 2.

An injection of four cubic centimetres of four per cent indigo carmine solution intravenously revealed a delay of five to seven minutes over the normal before any colouring matter was recovered from the pelvis of the right kidney. A rigor followed this procedure, but the patient responded well to appropriate treatment.

On this day, also, urine was collected in sterile test-tubes direct from the right kidney by means of the ureteric catheter and after centrifugalization and decanting the supernatant fluid, one cubic centimetre of the residue was inoculated into a guinea-pig, but without any effect.

January 1, 1932: It was noted that the temperature has touched normal for the first time for five weeks.

January 5: Pyrexia continues but is less marked, 100° to 101° F. at nights only. The patient is taking a T.B. diet well.

January 15: Blood-urea, 43 milligrammes per cent; urea concentration, 2·33 per cent; pyrexia is gradually subsiding.

Between January 20 and January 26, there was a hot controversy between the radiological and surgical departments of the Royal Herbert Hospital as to the correct interpretation to be placed on each pyelogram considered singly and together; peace was restored by referring judgment to three separate but highly eminent radiologists.

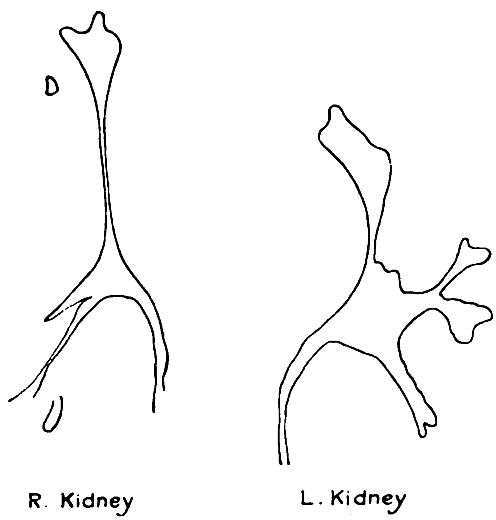


Fig. 1.—Abscess of kidney, R. Tracing of pyelogram of both kidneys obtained five minutes after intravenous injection of abrodil. Pelvis and calyces of R. kidney show marked deformity with considerable elongation and narrowing of the top and bottom calyces and apparent absence of the two middle calyces B and C, *vide* fig. 2.

Considering the X-ray findings alone, one pronounced that the radiological evidence was sufficient to justify exploration of the right kidney, while the other two considered that the X-ray findings were not incompatible with the normal kidney.

At this stage the author of these notes could find no one to support him in his explanation of the pyelograms, which was as follows:—

Fig. 1 fails to show the middle calyces owing to destruction of the middle third of the right kidney by disease, which, as the result of pressure, has caused well-marked elongation of the highest and lowest calyx. Since the middle third of the kidney is probably destroyed, no absorption of urine is occurring from the blood-stream by those tubules which collect and ultimately distribute to the two centre calyces.

Fig. 2 shows slight hydronephrosis with malformation of the upper

centre calyx, probably the result of pressure. From the comparative normality of the retrograde pyelogram it was deduced that the lesion was rather one of the collecting apparatus of the kidney than of the distributing apparatus.

On January 26, the patient was allowed up for the first time and by January 31 all symptoms had subsided. In view of this improvement, together with the general trend of expert opinion, it was decided to do

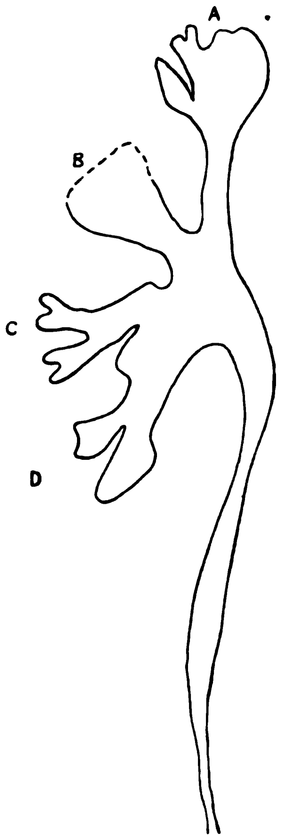


FIG. 2.—Abscess of kidney, R. Tracing of pyelographic shadow of R. kidney obtained by X-ray after retrograde catheterization of R. ureter and introduction of seventeen cubic centimetres of twenty per cent sodium iodide. Appearance suggests slight hydronephrosis. Note loss of indentation in calyx B and lack of definition in outline.

nothing operative. A note made on this date continues as follows: "It is believed that the underlying condition may have been a pyogenic abscess of the kidney from which the patient has recovered spontaneously."

Shortly afterwards the patient left hospital on twenty-eight days' leave, with a recommendation to be kept under observation for further symptoms.

Driver B. was re-admitted to hospital on March 8, shortly after return from leave, complaining of a slight persistent ache in the right loin. His

temperature and pulse-rate were normal, but his complexion was muddy; he looked depressed, and his vitality appeared to be low. He stated that while on leave he had been troubled by two or three attacks of epistaxis.

On examination of the abdomen there appeared to be a point of maximum tenderness just below the gall-bladder. Examination of the routine and twenty-four hour specimens of urine was entirely negative. The blood-pressure was 160 millimetres of mercury.

On March 15, the Consulting Surgeon to the British Army was asked to see the case and gave his opinion that exploration of the right kidney was definitely indicated. The most probable diagnosis was thought to lie between a closed tuberculous focus in the kidney or alternatively a closed pyogenic focus secondary to some source of sepsis elsewhere (in this case probably the appendix which had been removed).

On March 19, a second blood-urea examination gave a result of 45 milligrammes per 100 cubic centimetres of blood. Operation was deferred temporarily for considerations of leave and in the meanwhile, on March 28, a fresh rise of temperature was noted which continued remittently up to April 4, the day fixed for operation. The temperature varied between 99° F. in the morning and 102° F. in the evenings. After due preparation, exploration was carried out on the morning of April 4, under intratracheal (ether) anæsthesia.

The right kidney was exposed through a six-inch oblique incision in the right lumbar region, parallel to the last rib. On incising the perinephric fascia about half a teaspoonful of pus escaped, which appeared to have come from the right kidney. No definite abscess cavity could be located outside the kidney and at this stage the operator paused to consider the alternatives of (1) simple drainage of the perinephric capsule by a rubber drainage tube or (2) nephrectomy with drainage of the resulting cavity. Palpation revealed a large nodular kidney about fifty per cent bigger than the normal, very adherent to its surroundings, particularly towards the upper pole. Being by no means certain that the condition was not primarily tuberculous, nephrectomy won the day. With considerable difficulty the adhesions were divided, partly with the gloved finger and partly by ligature and cutting. Finally a large morbid kidney was brought to the surface and removed as soon as division of the ureter (as low down as possible) and the vessels could be effected. The wound was closed in layers, and a large rubber drainage tube brought out through the lower angle of the wound. The patient stood the operation well. Pus was noted to be coming from the drainage tube the fifth morning after operation and two days later the lumbar wound broke down necessitating removal of stitches.

The subsequent course of the illness was that of any serious pyogenic infection situated deeply and extraperitoneally in the upper abdomen. On May 11, resection of the eleventh rib was performed on the right side under gas and oxygen anæsthesia to permit of the transthoracic drainage of a collection of pus in the posterior subdiaphragmatic space,

by means of a large rubber drainage tube. The following day, May 12, the patient's condition was so critical that transfusion of 500 cubic centimetres of citrated blood was urgently demanded and successfully given as a life-saving measure. Routine irrigation and dressing of the two wounds with various antiseptics seemed to produce no great advance either in the patient's general or local condition until specially energetic measures were applied by Major G. S. McConkey towards the end of May. Thereafter a rapid recovery ensued. Both wounds healed, the patient's complexion cleared, his appetite increased, and temperature and pulse fell to normal.

On July 11 he was fit for discharge from hospital in normal health. On account of three large scars and a single kidney he was waiting for the verdict of an Invaliding Board.

A report on the condition of the diseased kidney removed by operation which has been rendered by the pathologist to the Royal Herbert Hospital, is as follows :—

"The specimen is a right kidney removed by operation. It is pathologically enlarged, appearing lobulated in outline and reminiscent of the fœtal type. The capsule is thickened and generally adherent to the cortex. There is a laceration near the upper pole corresponding to an abscess cavity the size of a walnut situated just below the upper pole. Bisection of the kidney shows that only a small quantity of normal renal tissue is present at both poles and that these areas are connected by a thin layer of healthy tissue which shuts off the diseased area from the pelvis and calyces.

"The area of disease includes a rough-walled abscess cavity, roughly spheroidal in shape, and about one inch in diameter, situated just below the upper pole. Apart from the areas of kidney tissue already referred to, the remaining central two-fourths is composed entirely of newly formed fibrous tissue.

" Microscopically the abscess cavity is pyogenic in type and no evidence of tuberculous disease can be found throughout the kidney."

The foregoing case is offered for publication on account of certain important conclusions which arise out of the facts herein presented.

(1) The importance of intravenous pyelography in difficult cases especially when combined with the older method of pyelography by means of ureteric catheterization. In this connection attention is invited to "Further Studies in Intravenous Pyelography" by R. J. Willan and James H. Saint (*British Journal of Surgery*, April, 1932, page 622).

(2) The value of early exploration of a kidney when thorough investigation points to a lesion in that organ. In this case it would appear that a pyogenic closed focus in the right kidney, secondary to a primary focus elsewhere, either healed spontaneously or became quiescent. The patient and the surgeon became lulled into a false security. Delay in operation resulted in infection of the perinephric space with all its attendant trials and dangers.

(3) Nephrectomy was the correct procedure since a second operation for the removal of the kidney would have been an impossibility. The alternative would almost certainly have been a permanent lumbar urinary fistula.

(4) A very gross amount of disease may be present in a kidney without any evidence obtainable from examination of the urine. It is in such cases that abrodil or an equally effective substitute will play a most important rôle.

BLOOD DONORS.

By Major A. HOOD,
Royal Army Medical Corps.

A.C.I. No. 70 of March 2, 1932. Record of soldiers who volunteer as "blood donors" in connection with transfusion of blood.

(1) In the treatment of severe cases of hæmorrhage and of certain diseases it is often necessary to call for volunteers to give some of their blood for immediate injection into the veins of a patient. Such volunteers are called "blood donors."

(2) In order to ensure that suitable blood donors are always available, it has been decided that a list of soldiers who volunteer as such and who have been accepted as suitable by a medical officer, shall be maintained in each unit. The numbers required are six in each regiment of cavalry, battalion of infantry or other units of equivalent size, and proportionally smaller numbers in the units which are smaller.

(3) The O.C. unit will call for volunteers and arrange direct with the O.C. the nearest military hospital for them to be tested. If a man is accepted an entry will be made on his A.F. B.178 (Medical History Sheet), stating his blood-group, that he is free from communicable disease and the date of examination.

(4) The O.C. unit will call for volunteers as necessary to replace blood donors who have permanently quitted the unit, or who have become unsuitable on medical grounds.

Consequent on this instruction a large number of volunteers came forward for grouping.

Method of Typing.

The method of typing adopted after trial of several methods is as follows:—

The donor's corpuscles are diluted in normal saline to approximately 1 in 20. At first a leucocyte counting pipette was used for this, but later the dilution was done roughly with ordinary Pasteur pipettes in Dreyer's dilution tubes.

One drop of Type 2 and one of Type 3 sera were then placed on a slide, a drop of the diluted corpuscles added to each and mixed with a matchstick and by rocking the slide; the result is easily read by the naked eye and where no agglutination is seen its absence is confirmed by microscopic examination. Advantages of this method are that diluted blood from a number of donors up to ten can be taken at the same time,

the test put up five at a time, and any test about which there is the slightest doubt can be repeated immediately.

The original type sera were obtained from the Royal Army Medical College, fresh supplies being taken from donors of Type 2 and Type 3. Tests were being done twice a week so that the potency of the serum was always being tested, and new batches of serum were tested against known Type 2 and Type 3 corpuscles.

No. typed	Group 1		Group 2		Group 3		Group 4	
	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage
262	9	3·4	108	41·2	32	12·2	113	43·1

These figures resemble closely those given by Beaumont and Dodds as being the approximate distribution of these groups in the population as follows :—

Group 1	Group 2	Group 3	Group 4
7 per cent.	40 per cent.	10 per cent.	43 per cent.

My original intention was to accept only Group 4 (Universal Donor) as donors, but reviewing my results early, I came to the conclusion that a unit would be best served by having a proportion of Group 2 and Group 4 donors available. It is well known that the best results from blood-transfusion are obtained if donor and recipient belong to the same group. It is not very easy to have a donor of each type with each unit, but it is almost always possible to have a proportion of Group 2 donors as well as Group 4 donors available with each unit, and this has been done as far as possible in the Aldershot Command. In addition, in large garrisons it is always possible to have a few Group 1 and Group 3 donors examined and tested and records kept of them, so that a donor of any group is readily available.

After being typed, each man's medical history sheet is examined and blood is taken for a Wassermann test; if there were more volunteers from any unit than were required, those with the best veins were taken; but while some veins were better than others, I did not have any difficulty in getting blood from all the volunteers typed.

Of the 262 sera sent for Wassermann test, all were negative except one which was shown as negative incomplete; this was later repeated and showed a strong positive Wassermann and Kahn test. The majority of these sera were also tested by the Kahn test and found negative. When the result of the Wassermann test is received, the following entry is made in A.F. B.178 (Medical History Sheet), Table VI, of each man found fit :—

"Accepted as a blood donor, blood group........
(If Group 4 the words 'Universal Donor' are added.)
Certified free from communicable disease :—
Wassermann Reaction: Negative, dated..................
Sgd......................
O. i/c Laboratory."

Employment of Donors.

It should be noted that under A.C.I.70 of 1932, units are responsible for keeping a list of available donors and also for replacing those who have permanently quitted the unit or become unsuitable on medical grounds.

It is suggested that the medical officer in charge of a unit, when checking the state of vaccination of units in January, could then see from the A.F.B.178 that the unit has the correct number of blood donors available.

Every hospital should maintain a list of blood donors, showing their groups and units.

When a blood donor is required, the blood-group of the patient should be ascertained and donors of the same group should be sent for. (This rule is strictly adhered to by the London Blood Transfusion Service.) An entry should be made on the donor's A.F.B.178, showing the amount of blood given, the nature of the patient's illness, the blood-group of the patient, and any reaction after the transfusion.

The donor's O.C. must be informed; for, although in civil life donors return to work at once, and after an experience of large numbers of transfusions from many donors the London Blood Transfusion Service is satisfied that no harm results to the donor from this, the soldier donor is entitled, under K.R., para. 1514, to a special furlough not exceeding twenty-one days which may be granted by his O.C., and an entry has to be made in his Regimental Conduct Sheet under K.R., para. 1630, sub-para. xx. The O.C. hospital in which the transfusion takes place should be responsible for giving the O.C. unit the required information.

A MODIFICATION OF THE THREE-HANDKERCHIEF METHOD FOR THE TREATMENT OF FRACTURES OF THE CLAVICLE.

By Captain H. G. G. ROBERTSON

Royal Army Medical Corps.

The simplicity, ease of application, adaptability to first-aid work, and excellent results of the "three-handkerchief method" of treating fractures of the clavicle are well known, and the present modification of the method has been designed with a view to retaining all these desirable qualities, and at the same time obviating one or two disadvantages inherent in the parent method.

The principle of this modification is the substitution of webbing straps for the handkerchiefs or slings, and the provision of buckles for fixation and adjustment. The apparatus can be made in a few minutes by any hospital "dhurzi."

Materials Required.

Fourteen feet of two-inch wide closely woven cotton webbing, similar to that used for lithotomy straps. (If this is unobtainable, "newar" may be used instead, but it is unsatisfactory, being too loosely woven. If "newar" is employed, it should be well stretched before use.)

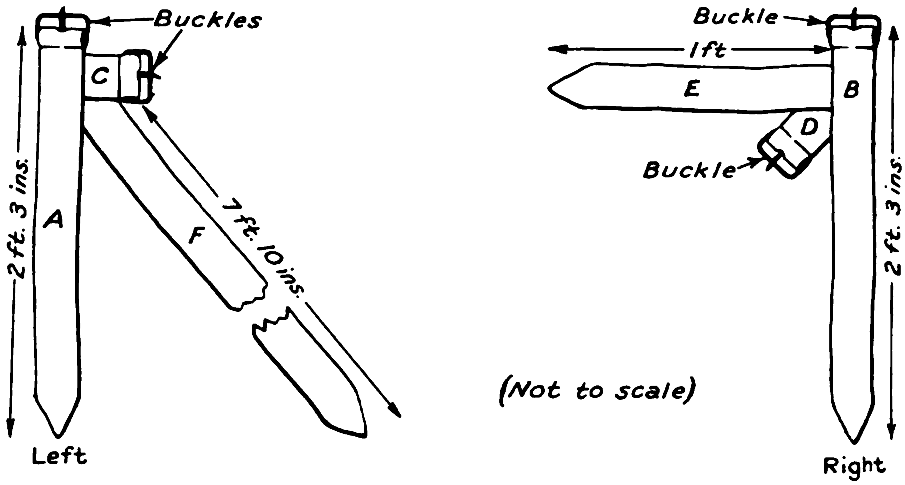
Four leather-covered buckles similar to those fitted to the waistbelt in the Royal Air Force.

Method of Making.

The webbing is cut into lengths as follows:—

A and B, two lengths of 2 feet 3 inches each; C and D, two lengths of 4 inches each; E, one length of 1 foot; F, the remainder of the webbing, 7 feet 10 inches.

These pieces are stitched strongly together as shown in the sketch, the buckles being attached in the appropriate places.



Method of Application.

(1) Cotton-wool is applied as padding to the axillæ, and front of the shoulders.

(2) A and B are passed round the left and right shoulder respectively, buckles uppermost, and fastened as tightly as can be borne comfortably. This leaves the other ends at the back, C and E being transverse, and D and F diagonally downwards.

(3) E is fastened to C, and tightened until the requisite amount of bracing back of the shoulders is obtained.

(4) F is passed diagonally downwards to the right, round the waist one complete turn, brought from the left side diagonally upwards, and buckled to D. This prevents the rest of the apparatus from slipping up and riding over the shoulder, and at the same time assists in bracing the shoulders.

Fig. 1.—Back view of patient with apparatus attached to show arrangement of straps.

Fig. 2.—Front view of patient with apparatus attached to show bracing of shoulders.

(5) Padding, if required, is adjusted under any pressure points.

(6) A "greater arm-sling" is applied in the ordinary way.

ADVANTAGES OF THE METHOD.

(1) Ease of application.

(2) Comfort in use.

(3) Easily adjustable at any required point.

(4) Cannot slip.

(5) Cannot stretch, therefore minimum adjustment is required.

(6) Being made of broad webbing, and all knots being eliminated, causes less pressure, and therefore requires less padding.

(7) Cheap to produce, and lasts long.

FIG. 3.—Front view of patient after application of sling.

I am indebted to Major A. P. Draper, M.C., R.A.M.C., O.C., B.M.H., Risalpur, for permission to send this account for publication.

Echoes of the Past.

THE ARMY MEDICAL SERVICES 1816-1825.

BY LIEUTENANT-COLONEL G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps (R.P.).

THE MEDICAL SERVICES AFTER WATERLOO.

WHEN the first enthusiasm for the victory had subsided, the country began to view the maintenance of the military forces with impatience. The establishment at home was cut down to the bare minimum necessary to suppress civil disturbance. Garrisons abroad remained there, out of sight, and therefore conveniently out of mind, with small prospect of relief. Conditions during the next forty years were not such as to foster the growth of fresh military talent or favour administrative improvements. In the Army itself, up to and well into the period of the Crimean War, the test of Peninsular experience and tradition was blindly applied to almost every problem that arose, whether in tactics or economy. In the Medical Department, the abolition of the Military Train deferred indefinitely the consideration of sick transport in war, so vital to its successful operation. In other respects, however, the condition of the Medical Services was not one of complete stagnation. The reduction of the establishment provided an opportunity for selection, which Sir James McGrigor did not neglect. Numbers of the officers placed on half-pay were without medical degrees. He advised them to attend the medical schools, and let it be known that their return to the active list would depend much on their diligence at their studies. He himself set them an example by attending clinical lectures in London.

Over his officers in India the Director-General had little control; but elsewhere he instituted the regular submission of medical reports and health statistics, which were now for the first time tabulated in such a way as to afford a comparative view of the health of the various military stations. The results, published later at his instigation, had a powerful effect in rousing public opinion in support of the measures necessary to improve matters. The first of these reports, that on the West Indies, which appeared in 1835, was compiled by Henry Marshall of the Army Medical Department and Captain Alexander Tulloch of the 45th, two officers who devoted their lives to the welfare of the soldier. Marshall, who was for many years staff surgeon in Ceylon, was the first to apply the new science of vital statistics to the service of the Army. Besides his "History of Ceylon" and contributions to the medical journals on pensions, recruiting, suicide in the Army, flogging, etc., he published in 1846 a "Military

Miscellany," which, in spite of its criticisms of prevalent military methods, was favourably received, and referred to on one occasion by Lord Panmure, when Secretary at War, as "my Bible in all that relates to the soldiers, welfare." On Marshall's death in 1851 his statistical work was carried on by Dr. Graham Balfour.[1] Tulloch, who prior to entering the Army received a lawyer's training, started his life's work when, as a subaltern, he exposed various scandals connected with the regiment's food and pay, and pension frauds tolerated by the Honourable East India Company in Burma. His report as a commissioner sent by the Government to the Crimea roused the hostility of the Horse Guards over the question of responsibility. His services were eventually recognized by promotion to the rank of Major-General and a K.C.B.

McGrigor's ambition to found a Medical School for the Army was not fulfilled, but his library and pathological collections became the nucleus for the museum established in after years at Fort Pitt, Chatham. The study of tropical disease, the special opportunity of the army physician, was not neglected. Robert Jackson lived till 1827, Edward Bancroft resigned his position as physician at St. George's Hospital, to rejoin as deputy-inspector in Jamaica in 1811, where he remained thirty-one years. Sir Arthur Brooke Falkner, who had fought the plague at Malta in 1813, was an authority on that disease. Sir William Pym (1772-1861) wrote the first accurate account of yellow fever and of the three days' fever of Malta now traced to the sandfly. In the cholera epidemic of 1832 he was appointed chairman of the Central Board of Health. As scientists, John Vaughan Thompson, the zoologist (1779-1847), and William Freeman Daniell, F.L.S., hold places of distinction; Andrew Smith was a recognized authority on the fauna and ethnology of South Africa. In surgery, it is doubtful if much progress was made. Many of the Peninsula surgeons retired to take up private practice. John Hennen, the author of a standard work on military surgery, died as Inspector of Hospitals at Gibraltar in 1828. George James Guthrie, who was now surgeon at Westminster Hospital, made all medical officers welcome at his lectures, and Sir George Ballingall, late of the 33rd, who from 1825 to 1855 held a chair of military surgery at Edinburgh, was an equally good friend. Here also Robert Knox, another ex-army surgeon, enjoyed great popularity as an anatomy demonstrator, till his career was interrupted by the revelation of his injudicious, if innocent. negotiations with Burke and Hare, the notorious body-snatchers.

An impression of the daily life of an army surgeon may be gathered from Sir James McGrigor's "Reminiscences," from Walter Henry's "Events of a Military Life," and from Mitra's "Life and Letters of Sir John Hall." In literature, characters based on the personality of the erratic Irishman, Maurice Fitzgerald Quill, are found in some of the

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[1] For an appreciation of Henry Marshall's Life and Work, *vide* John Brown. "Locke and Sydenham with other Occasional Papers." Constable, Edinburgh, 1858.

Peninsula War novels. Truer types occur in some of Thackeray's works: old Cutler the surgeon of the 150th, who, when Amelia was presented to the regiment, made one or two jokes to her, "which, being professional, need not be repeated," and "Cackle, the assistant, M.D. of Edinburgh, who condescended to examine her on *leeterature,* and tried her with his three best French quotations." In the "Book of Snobs" there is a passing reference to the "Medical Military Snob, more outrageously military in his conversation than the greatest sabreur in the Army." Then there is Dennis Haggarty of the 120th, "a large, lean, tough, raw-boned man, with big hands, knock knees, carrotty whiskers, and withal as honest a creature as ever handled a lancet," a simple and kindly soul, whose meek submission to ruin at the hands of a heartless wife and rapacious mother-in-law fill us with some impatience. Perhaps the best-known characters are Dicken's Dr. Slammer, the testy and pompous surgeon of the 97th, and his truculent friend Payne of the 93rd, encountered by the members of the Pickwick Club at Rochester in 1827. Slammer has been claimed by the historian of the East Lancashire (30th) Regiment as Surgeon S. A. Piper, M.D.; no doubt the others were also drawn from life.

Considerable nonsense has been written from time to time about the social status of the army surgeon. It was, however, something more than snobbery which influenced members of the profession during the first half of the nineteenth century to agitate for the promotion of the senior officers of the Department to a plane identical with that of combatant officers of corresponding rank. There was strength in the argument that though they were the proper advisers on measures necessary to keep medical administration abreast of scientific progress and on the application of the laws of hygiene to the problems of sick wastage, the position officially accorded them suggested an inferior class of person hired cheaply to do everyday work of no particular importance. This weakened their power to make their representations effective. The first admission of the doctors to the Military Order of the Bath was in the year 1850, and was largely owing to the efforts of their very good friend, General Sir George de Lacy Evans.

As the testimony of one who was always outspoken enough in his criticisms, the remarks of Sir George Napier in 1828 may be quoted: "It is a very general, but unjust idea to think slightly of the medical men, for few officers receive so good an education or are so generally acquainted with science and literature. I am bound to state that if one takes the conduct of the whole Medical Department of the Army into consideration, one will find few such large bodies of men who are more distinguished for their kindness, skill, and indefatigable exertions for the health and comfort of the sick and wounded; and, as to danger, the medical officers of the British Army have, without exception, invariably shown an utter contempt for it either in the field of battle or, which requires a higher courage, in the hospitals of plague or yellow fever."

If their amenities were not great, the regimental hospitals at this date

were well ordered. Baron Larrey who visited some of them was much impressed by their efficiency. The instructions issued by Lacy Evans, Commander of the British Legion in Spain during the Carlist War, dated Vittoria, March 4, 1836, exemplify the best ideas of the time on sanitation in the field. His P.M.O. was Rutherford Alcock, later a distinguished member of the Consular Service.[1]

"Troops should have a hot breakfast, cocoa or broth where possible. For dinner, plain warm food should be supplied. Wine or spirits are unnecessary, but a little of the latter is sometimes useful. The soldier should sleep eighteen inches off the ground. Where this is not practicable, and occupation exceeds a week, hay, straw or rushes should be provided. Officers to see every man in his bed. On rising, men should strip naked, and, if they cannot wash, shake themselves, and also shake out their blankets. Quarters to be cleaned before breakfast. In marching, avoid the heat of the day; marches should not exceed 10 miles, with one or two short halts. The best time to start is an hour before daylight.

"Every regiment should have two carts for the sick, lame, and lazy, in charge of the surgeon, and one extra for the staff surgeon of each brigade; each cart carrying, in boxes under the seat, medical stores and comforts, but not the instruments. They assist the tired in carrying their knapsacks, their arms occasionally, and the men if it cannot be helped. A surgical mule to be supplied for panniers and instruments. The surgeon should not be ordered to attend parade for form's sake, but be sent to examine the quarters when the people are out of them. Encampments should be near water. Never remain on moist ground in September or October or on the top of a hill near marshy ground. If the troops get sick, let the surgeon watch them to find out the cause. Keep the people employed and change their quarters if unhealthy.

"Every regiment to look after its own sick in quarters. Bedding to be obtained by requisition from the *Alcade*, or better, each surgeon to carry 12 sets with him. When the troops move, the sick of the brigade to be collected and left in a brigade hospital under an assistant surgeon. The town to supply bedding. Small general hospitals, either Spanish or British, to be formed in fortified towns along the line of march at 20 to 30 miles interval. On the march the brigade-surgeon sees every man sent to the rear, the surgeons marching with the wagons, and reporting each man left behind. Permission to fall out must be given by the Company Commander, and men permitted to do so must be given a card. Discipline should be summary. Each regiment to have an assistant provost marshal and a drummer. Flogging should always be on the breech. Wounded must find their own way to the rear during an action."

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[1] From "The Memoirs of Colonel Charles Shaw." The Legion 10,000 strong was sent to support Queen Isabella against the Carlists. It did gallant service and got little thanks. It was withdrawn in 1837.

THE EAST INDIES, 1810 TO 1818.

During the progress of the war in Europe there was a British garrison of some 24,000 men in the East Indies. In the autumn of 1810, successful attacks were made on Bourbon and Mauritius. In April, 1811, 1,200 troops, including six British regiments, were despatched under Sir Samuel Auchmuty to effect the conquest of Java. This force concentrated at Malacca in June, and reached its destination in August. During the voyage, "the salutary regulations laid down by Colonel Agnew, Adjutant General, by order of the Commander-in-Chief, for the treatment of both men and horses, and the provident care of Sir Samuel Auchmuty, who, like an affectionate parent, was attentive to every suggestion that could contribute to the preservation of the health of the troops, were productive of the most beneficial effects."[1] However that may be, 1,200 sick were left behind at Malacca, and there were 1,500 more on August 4 when an unopposed landing was made on the coast of Java.

The island and its dependencies were formally surrendered by the Dutch after six weeks marching and fighting among swamps and rice fields, where many of our men succumbed to heat-stroke and exhaustion. Expeditions to neighbouring islands followed. The Superintending Surgeon, William Hunter, of the Bengal Establishment, was one of the victims of the climate. Among other deaths recorded in the Medical Service was that of Assistant Surgeon John Leyden, of the Madras Army, the Scottish Poet, who collaborated with Sir Walter Scott in compiling the "Minstrelsy of the Border." His passion for Oriental travel and the languages and literature of the East, had induced his literary friends to procure for him the appointment in the Company's Service, for which, by intensive study, he is said to have qualified in six months! He seems to have died of malaria.

On the problems of the disposal of sick and wounded in Indian Frontier Warfare, first experienced in the Gurkha Wars of 1814-15, the Nepal Papers unfortunately throw no light, but, where there were no roads, hand carriage must have been practically the sole means of transport. The operations consisted in assaults on positions chosen and occupied by the enemy among the hills. The first year's proceedings were neither creditable to our arms nor successful. In 1815 Sir David Ochterlony, having mastered the enemy's methods, advanced with a strong force on Katamandu. The enemy came to terms, and a satisfactory and lasting treaty was concluded. In 1817, Lord Moira, the Governor-General, assembled the largest army so far brought together in the British Service for the pacification of Central India, which, since the decline of the Moghal dynasty, had been disturbed by marauding bands of Pindaris with the connivance of the Mahratta chiefs. The concentration of 120,000 troops and 40,000 followers resulted in the first serious visitation of cholera among British troops in India. The main British camp was affected, and, in less than a week the force was

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[1] Major W. Thorn, "Memoirs of the Conquest of Java."

decimated. For a fortnight the place was a hospital. The Governor-General escaped, though his household was attacked by the disease, and he made all arrangements, in the event of his death, to be buried secretly in his tent, lest the news should give encouragement to the enemy. There was much hard marching under trying conditions. The only pitched battle of importance was the engagement fought at Maheidpoor on December 21, 1817, between a force of 5,500 men under Sir Thomas Hislop and the army of Holkar. This battle is borne on the colours of the Royal Scots; the two other British regiments engaged being the 22nd Light Dragoons and the Company's Madras Europeans (Royal Dublin Fusiliers), now both disbanded. Our casualties in a frontal attack were 174 killed and 621 wounded. The medical arrangements, the direction of which was in the hands of the Company's surgeons, came in for severe criticism on this occasion. The official historian, quoting a contemporary writer, says, "In the field hospitals there was scarcely a bit of sticking plaster for the wounded officers, and none for the men; nor was there a single set of amputating instruments besides those belonging to individual surgeons, some of these without them; and we have the best authority for saying that, of those amputated, from the bluntness of the knives and the want of dressing plaster alone, two out of every three died in hospital."

The inadequacy of a purely regimental medical system in the field had been appreciated by the Duke of Wellington, and provided against in the Assaye campaign, but the lesson had not been absorbed. In India the surgeons not only provided their own instruments, but were still the contractors for medicines and stores.

An obelisk on the bank of the Bhima River, seventeen miles north-east of Poona, commemorates the affair of Koregaon, when Captain Stanton with 600 men of the 2/1 Bombay Infantry, 300 of the Poona Horse and two guns, defied for twenty-four hours the whole strength of the Peishwa's army. "Not only the combatant officers, but the assistant surgeons, Wyllie and Wingate, led their troops to the attack again and again, and there can be no doubt that the presence of the British officers alone saved the force from annihilation." Wingate was killed. Two other medical officers of the Indian Service, Assistant Surgeons H. D. Niven and Archibald Anderson fell in this campaign.

In May, 1818, a campaign of sixteen months terminated with the complete subjugation of the island of Ceylon. Guerilla warfare among swamps and jungles, where the sick had to be carried in blankets slung on bamboos, caused terrible sick mortality. Surgeon John Hoatson, of the 73rd, reported 356 deaths in his regiment during the year. The 19th, 73rd and 83rd, who bore the brunt of the operations, lost 300 men in three months.

Saint Helena, 1815-1821.

The Emperor Napoleon died at St. Helena on May 5, 1821, after five and a half years captivity. His last illness has been recounted at length

by numerous writers. Even when the cause, cancer of the stomach, had been determined at the autopsy, critics of the Government continued to maintain that his life was shortened by the climatic conditions of the island.

The position of the Emperor's medical attendant was no easy one. Napoleon and his entourage pursued a policy of bitter hostility towards the Governor, Sir Hudson Lowe, who seems to have been rendered unduly suspicious by the burden of responsibility. There was no personal intercourse between Longwood and Government House, and, after a time, Napoleon shut himself up, and was hardly seen. Into the quarrel the unfortunate doctor was inevitably drawn, being liable to be regarded either as the patient's partisan or the Governor's spy.

Mr. Baxter, the Deputy Inspector of Hospitals during the first years, Napoleon refused to see. At his request, he had been assigned, as personal physician, a young naval medical officer, Barry E. O'Meara, who remained with him for three years. O'Meara received a commission as assistant surgeon of the 62nd in 1804, and served in Sicily and Calabria, subsequently taking part in the Egyptian campaign of 1807. Shortly afterwards he lost his commission on account of being involved in a duel, but became a surgeon in the Navy, where he won the good opinion of at least one of his commanders, Captain Maitland of the "Bellerophon." In this ship he was serving when the Emperor surrendered himself. Napoleon, though he seems to have had no great opinion of his medical skill, found O'Meara personally acceptable, and, by judicious handling, very quickly enlisted his services in the campaign against the Governor. O'Meara diagnosed the Emperor's illness as inflammation of the liver, caused by the climate of the island. He quarrelled with Sir Hudson Lowe, and behaved generally with such indiscretion that in October, 1818, he was ordered home, and later dismissed the Navy. His case was taken up by the Opposition, and, being a ready writer, his book published in 1819, in which he stated that Napoleon's life was not safe in Lowe's hands, made some stir. Dr. Verling of the Artillery was ordered to succeed O'Meara, but Napoleon would have none of the Governor's choice. On January 1, 1819, the services of another naval surgeon were requested by Napoleon's attendants. This was Dr. John Stokoe, surgeon of H.M.S. "Conqueror," who had been called in previously by O'Meara in consultation. Stokoe seems to have been a well-meaning, but weak man. He paid five visits and concurred in the former diagnosis, but, finding himself involved in an impossible situation, he obtained leave to go home. On arrival, he received orders to return, was court-martialled for breach of discipline and disobedience to his admiral's orders, and dismissed the Navy. He was within a few months of his retirement, and the hardness of his case seems to have been appreciated, for he was subsequently allowed to receive his pension in view of his long and meritorious service.

Napoleon, on O'Meara's departure, had asked that he might be attended

by one of his own countrymen. On September 20, 1819, Dr. Antommarchi, selected by Cardinal Fesch at the British Government's request, arrived at St. Helena. The Cardinal was Napoleon's uncle. The choice appears to have been an unhappy one, though for a time he gave satisfaction to the Emperor. He was a young man of thirty, without much experience, and of a frivolous disposition. Napoleon had little confidence in him, and he neglected his duties. He was already under orders to go home when the end came. He continued to treat the patient for inflammation of the liver. In March, 1821, Napoleon, suffering agonies from the emetic he had administered to him, writhed on the floor, called him an assassin, and declared that he would have nothing more to do with him.

Marshal Bertrand and Comte de Monthalon, after much entreaty, now persuaded the Emperor to allow himself to be seen by Dr. Archibald Arnott, the surgeon of the 20th. The first visit was paid on April 1. The room was in almost complete darkness, and Arnott reported to the Governor that the person he had just attended, whether General Bonaparte or some-one else, appeared to be in a state of considerable debility, judging from his pulse, but in no immediate danger. Next day he was allowed to make a more thorough examination, and his visits were continued until the Emperor's death six weeks later. Treatment, prescribed in consultation with Antommarchi, was symptomatic. Arnott could find no evidence of any affection of the liver. The disease ran its usual distressing course, and, after much suffering, the Emperor breathed his last on the evening of May 5. One of his last acts had been to dictate the terms of the letter which was to inform the Governor of the event. He expressed a desire at the same time that a post-mortem examination should be made, but that no British medical officer, other than Arnott, should approach his body.

Under the Governor's instructions, Thomas Shortt, the physician and principal medical officer of the troops, at once proceeded to Longwood and was admitted to view the body. The autopsy took place the following day in the entrance hall of the house, being performed by Antommarchi under Shortt's close supervision. The report was signed by

Thomas Shortt, physician and P.M.O.
Arch. Arnott, M.D., surgeon, 20th Foot.
Charles Mitchell, M.D., surgeon, H.M.S. "Vigo."
Francis Burton, M.D., surgeon, 66th Foot.
Matthew Livingstone, surgeon H.C. Service.

The assistant surgeons of the 20th and 66th, G. H. Routledge and Walter Henry, were also present, as well as the Adjutant-General, Sir Thomas Reade, Major Harrison, Captain Crocket, the orderly officer, and six of the Emperor's suite. The greater part of the stomach was infiltrated with cancerous growth, and at the pyloric end there was a large ulcer. The substance of the liver was reported to be unaffected. Henry, in his "Events of a Military Life," published in 1843, devotes several pages to an account of his time in St. Helena, where he arrived with part of his

regiment in July, 1817. The officers of the 20th were presented to Napoleon, including himself and Dr. Heir, the surgeon. Henry was asked about the prevalence and treatment of hepatitis in India, and the consumption of arrack by the troops. The Emperor had evidently formed the opinion that the British Army generally was very much addicted to alcohol.

Arnott's pamphlet on the Emperor's last illness deals only with professional matters, consisting, in fact, of a series of bulletins. We know from other sources that his services were appreciated. On one occasion he was given a copy of "Marlborough's Life" for the regimental mess, and Napoleon gave him a snuff-box for himself, on which he scratched with his own hand the Letter N.

Henry, after serving in the Canadian Rebellion, rose to be a deputy-inspector general. Arnott retired in 1826, and died a country gentleman and magistrate in Dumfriesshire in 1855. Shortt also left the Service soon after, and retired in Edinburgh, where he resided in Queen Street, and supplied some details to his neighbour, Sir Walter Scott, when he wrote Napoleon's Life. He died in the Isle of Wight in 1843 at the age of 54. O'Meara died in obscurity in 1836.

The following books refer to Napoleon at St. Helena, all by medical men except the last :—

"Letters written on board H.M.S. 'Northumberland' at St. Helena," William Warden, London, 1816.

"An Exposition of some of the Transactions at St. Helena," B. E O'Meara, London, 1819.

"An Account of the Last Illness, Disease, and Post-mortem Appearances of Napoleon Bonaparte," Archibald Arnott, M.D., London, 1822.

"Napoleon in Exile, or a Voice from St. Helena" (2 vols.), B. E. O'Meara, London, 1822.

"Memoirs du Docteur F. Antommarchi" (2 vols.), F. Antommarchi, Paris, 1825.

"Events of a Military Life," Walter Henry, London, 1843.

"Napoléon prisonnier (the Diary of Dr. Stokoe)," Paul Frémeaux, Paris, 1901.

THE BURMA WAR, 1824-1825.

In 1824 the King of Ava, who had absorbed all the Burmese States into his dominions, and pushed an army into Assam, was threatening an invasion of British India. This led to a declaration of war by Lord Amherst and two years of fighting as arduous and as costly in life and health as British soldiers have ever been called on to undertake. The country, about which practically nothing was known at the time, has, as a rule, practically no cold weather, and the monsoon, which lasts from early May to September, is more severe than anywhere in India. Roads were mere tracks through swamp and jungle, and impassable in the rains. For months there was no transport, no fresh provisions were available, not even milk or eggs for the hospitals. It had been hoped to collect both transport

and supplies on landing, but the enemy retired into the jungle, devastating the country behind him.

In May, a most unfortunate time of year to commence operations, a force of three infantry brigades and artillery, which included H.M.'s 13th, 38th, and 41st regiments, and the 1st Madras Europeans, with native troops, appeared off Rangoon under Sir Archibald Campbell. This was followed a month later by a fourth brigade with H.M.'s 89th. A naval flotilla accompanied the expedition. No superintending surgeon was appointed, the medical staff being found from regimental officers of the home and H.E.I.C.'s Service.

Rangoon was occupied on the 11th and found deserted. The town was put in a state of defence, and here the troops were compelled to remain through June and July, easily beating off the enemy's attacks, but unable to advance for want of transport, and owing to the flooded state of the country. The river approaches were blocked by the Burmese, and covered by positions occupied on the banks, which needed land operations to assault. The rain destroyed the rations. The salt pork went rotten and the biscuits mouldy. There seems to have been plenty of arrack, and it is not to be wondered at that the men took far more than was good for them. Dysentery started, and the whole force was heavily infected with malaria. In June scurvy appeared, wounds refused to heal, and there were cases of hospital gangrene. The leech bites from which the Indian troops suffered, developed into fearful ulcers, which frequently led to amputation. By August 3,586 men were unfit for duty. The European regiments had each from 200 to 300 men in hospital, and were burying from three to six a day. Such was the state of the ground, that the corpses had to be huddled into a shallow pool and hastily covered with earth before they should rise to the surface. By this time a certain number of luxuries could be obtained from private traders who had arrived by sea, but at enormous expense. Dr. Campbell of the Madras Europeans is referred to in the annals of that regiment as one who "for his extreme liberality and kindness to the sick during the great sickness and scarcity, will be remembered by the survivors as long as they live." The patients were moved to the ships anchored off Rangoon, but no great advantage resulted until, at the end of the year, the military occupation of the Tenasserim coast rendered possible the establishment of a convalescent depot at Merjui.

At the end of September the Burmese concentrated 60,000 men against our positions at Rangoon and Kemmendine, but were beaten off after a week's heavy fighting. During the course of the winter reinforcements were sent out, including the Royals, the 47th, 87th and eight battalions of Madras Native Infantry. In February, 1825, Campbell advanced up the Irrawadi. By this time the Army was better off for food, owing to the arrival of supplies from India, and the return of some of the natives with their cattle to their homes. From want of transport, the British soldiers still had to push the guns through the swamps by hand, and they marched

with knapsacks, blankets, and sixty rounds of ammunition. Each man had to carry three days' rations. Prome was occupied at the end of April, and on the termination of the rains the advance on Ava continued. After many difficulties had been overcome, the force reached a point forty miles from the capital, when the Burmese gave in. A treaty was concluded in February, 1826.

Meanwhile attempts had been made to carry on the war on the western frontier. In April three infantry brigades, including H.M.'s 44th and 54th, advanced from Chittagong, under Brigadier-General Morrison, into Arakan. Here the men died by hundreds. In September, the Europeans, 1,500 strong, buried 259. The 8,000 Indian troops had 900 deaths. In eight months the two British regiments had lost half their strength. The expedition was abandoned, the General himself dying on the way back to India. The men of the 44th and 54th on their return presented a pitiable appearance. "Their countenances of a dull saffron hue, their lips pale, their features swollen and œdematous, their abdomens tumid, and their whole persons enlarged in bulk; all were labouring under disease of the spleen or derangement of other important organs.[1] They were all cases for hospital. Within six months half of them were dead." The mortality from sickness in the Peninsular War is said to have been 12 per cent per annum; in Burma, during the first twelve months, the European troops lost 45 per cent. Of the 150 officers and 3,586 men in the five King's regiments originally landed at Rangoon, 45 officers and 3,100 men died.

Malaria and dysentery caused most of the casualties at Rangoon; cholera contributed. A number of cases of œdema suggested to some of the surgeons the possibility of beriberi. The sickness in Arakan may have been kala-azar. The "vomiting of disgusting worms" mentioned as a common symptom may imply a widespread infection with threadworms, a common enough event in Assam. Heat-stroke accounted for no more than eleven deaths. It is sad to find that it was necessary amid so much misery to add 174 cases to the hospital admissions on account of *punitus*, i.e., flogging. The writer has traced no more than six deaths in the Medical Services, those of Surgeon H. Cowan (41st), Assistant Surgeon G. Leich (87th), and Surgeon Grant and Assistant Surgeons W. F. Reeks, A. Spiers and H. Maysmor of the Madras Army, the last in action. Many others suffered permanent impairment of health.

The commencement of the monsoon was a bad time to land in the country, but it was apparently selected to facilitate the transport of the troops up the river. The need for land transport was realized late. When the river was left behind, the carriage of wounded was almost entirely by hand; on two unfortunate occasions casualties were lost owing to the panic of the doolie-bearers. When the results of the shortage of fresh

[1] Parliamentary Papers, 1825 (360), xxiv, 91.

provisions were reported to the Governor of Madras, he blamed the medical authorities for not having represented the danger earlier, when he would have sent out enough bullocks to supply fresh meat for the hospitals. This, however, would scarcely have met the case. The Governor General in Council acknowledged the services of Superintending Surgeon Heward[1] on the termination of the campaign, but there is no evidence that any medical authority was consulted beforehand. No Principal Medical Officer appears on the Staff of the original force. The Governor-General also observed that attempts should have been made to procure fish and plant vegetables. This would have been difficult in a swamp.

Sir John Fortescue thus sums up the state of the British soldiers in the first Burma War: "Unsuitably clothed, vilely fed, imperfectly tended, drenched with rain when they were not bathed in sweat, eaten up by mosquitoes, leeches, and the manifold other plagues of a tropical delta, they had literally nothing but misery and death before them. Active operations were their only relief."

No records were kept by the Company's surgeons. Dr. Grant, the senior medical officer with the force in Arakan, was one of the first victims to the climate. He was succeeded by Dr. Grierson. The following British Service officers have "Burma 1824-25" to their credit in the old Army Lists: Surgeon R. W. Sandford (Royals), Surgeon H. Hamilton and Assistant Surgeons Jas. Henderson and Jas. Mouat (13th); Surgeon Martin Cathcart and Assistant Surgeon John Dempster (38th); Surgeon Henry Cowan (41st), died; Surgeon W. Daunt and Assistant Surgeon W. Verling (44th); Assistant Surgeon Jas. Patterson (45th); Surgeon Archibald Millar and Assistant Surgeon Moses Griffith, wounded (47th); Assistant Surgeon George Leich (54th), died; Assistant Surgeon W. P. Birmingham (87th); Surgeon Michael Murphy and Assistant Surgeon Jas. Walsh (wounded) (89th); Assistant Surgeon Alexander Cummings.

Some twenty-five surgeons and assistant surgeons of the Madras Army served in the war, several of whom appear to have been young men engaged locally in Madras. The 1st Madras Europeans, when they disembarked, had as their surgeon Dr. J. Deane, one of the heroes of the Vellore mutiny of 1806.

Surgeon H. H. Wilson, of the H.E.I.C., wrote a narrative of the First Burma War. As a result of the campaign, Arakan and Tenasserim were annexed to the Crown.

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[1] Sir Simon Heward, Knighted 1837.

Current Literature.

RICHARDSON, L. V. **Diphtheria Antibodies Transmitted to the Offspring of Immune Guinea-pigs.** *J. Immunology.* 1932, v. 22, 351-8.

Diphtheria antibodies, antibacterial (agglutinin) and antitoxic, were titrated in the serum of the offspring of female guinea-pigs immunized with a filtrate from the diphtheria bacillus. Both antitoxin and agglutinin was found to be placentally transmitted. The proportion of antitoxin to agglutinin found in the sera of the offspring shortly after birth corresponded with that in the serum of their respective mothers.

The sera of a number of families were studied over periods of sixty or more days following birth. The data show that the duration of passive immunity of the offspring is related to the amount of antibodies originally transferred by the mother. The method of following the "antibacterial" antibody was by means of its agglutination of a degraded diphtheria strain —a method previously described by the author [this *Bulletin*, 1931, v. 6, 583]. C. C. OKELL.

Reprinted from "Bulletin of Hygiene," Vol. 7, No. 10.

H. STEIN. **Skin Allergy and Tuberculosis Therapy.** *Zeitschrift für Tuberculose.* 1932, 66, 238.

The author refers to the specific per-cutaneous therapy by means of tuberculin introduced by Petruschky and improved by Wolff-Eisner. He states that excellent results have been obtained by the application of "Santubin" to the skin of the abdomen in cases of tuberculosis. "Santubin" is a tuberculin ointment of special composition. It is said to meet all theoretical demands and successful results with it have been reported by Wolff-Eisner, Eckstein, Gunter, etc. The author has carried out "Santubin" treatment for the last three years in numerous cases of tubercular ailments in various stages, with considerable success. From the results of his observations he concludes that the von Pirquet reaction is an important aid to treatment as well as for diagnosis. He found, in successful cases, a uniform increase in the reaction soon after the treatment was commenced; if there was no increase in reaction the prognosis was unfavourable.

ADENEY, W. E. **The Bio-Chemical, Bio-Physical and Physical Principles underlying the Self-Purification of Crude Sewage Liquor.** *Surveyor.* 1932, v. 82, 91-3.

Important advances in our knowledge of the scientific principles underlying the new methods of treatment in sewage purification have clearly demonstrated that the economical and satisfactory disposal of normal crude sewage liquors depends upon the completeness with which all solid organic impurities in visible suspension, *including those in the colloidal state*, are

in the first instance separated from the impurities present *in true solution* in the liquors; and upon the efficiency of the methods subsequently utilized for effecting the self-purification of the two classes of impurities resulting from the methods employed in their preliminary separation. Thus we have: (1) The removal of the coarse solid impurities in the form of sludge from the crude sewage liquors by mechanical sedimentation. (2) The removal of the solid impurities remaining in fine visible suspension, and, in the colloidal state, in effluents from sedimentation tanks, by means of the activated-sludge process. (3) The bio-chemical purification, under *anaerobic* conditions, in digestion tanks of the mixed solid impurities removed from the crude sewage liquors by the above two methods of separation. (4) The bio-chemical purification, under *aerobic* conditions, of the organic and ammoniacal impurities in true solution in the effluents from the activated sludge aeration tanks, either through the agency of filter beds or by adequate dilution in "clean" rivers or streams.

The author discusses the bio-chemical changes which take place in sewage matters under aerobic and anaerobic conditions and enunciates the following law: "The quantities of oxygen consumed, and of products formed, on the completion of each stage of aerobic fermentation, are constant for similar volumes of the same polluted water. This law is applicable to all polluted waters, tidal and non-tidal, undergoing purification by bacteria fermentation, provided that the dissolved oxygen is in excess of the fermenting matters." In regard to the inoculation of fresh sludge with stale sludge in a state of active fermentation he draws the conclusions from the experimental investigations that have been made, that the particular varieties of saprophytic bacteria concerned in the self-purification of sewage impurities are controlled by the nature of the oxygen supply at their disposal; i.e., whether the oxygen be in the *free* state (aerobic conditions), or in the combined state (anaerobic conditions); and in the case of solid organic impurities, whether the fresh sludge be inoculated with sludge that is in a state of fermentation or not.

The author suggests that the possibility of effecting the purification of solid impurities under anaerobic conditions without nuisance, as in the Birmingham digestion tanks, is due to the presence of the humus by-products in the *fermented* sludge with which the *fresh* sludge is mixed as it enters the digestion tanks. The rapid growth and multiplication of the bacteria in sewage liquors is not only attended by bio-chemical processes of oxidation, but also by bio-physical processes, which cause a rapid flocculation of the organic impurities existing in the sewage liquors in the colloidal state, and a consequent rapid precipitation, in association with the finely divided solid organic impurities carried in visible suspension by sedimented sewage liquors, before either class of impurities has been appreciably affected by the bio-chemical processes of oxidation by the same bacteria.

This is the scientific explanation for the successful modification of the

activated-sludge process (Birmingham, 1922), for the treatment of the sedimented sewage liquors, previous to submitting them to filtration ; and by means of which it was found possible not only to pass the liquors, after treatment in the aeration tanks for one hour, on to the filter beds at twice the rate of flow, but also to flocculate the organic impurities occurring in the colloidal state in the sedimented sewage liquors; and so to provide for the collection together of all the solid impurities occurring in visible suspension, and in the colloidal state, in crude sewage liquor, for final disposal by purification in the digestion tanks. Since the efficiency of the activated-sludge process depends on the rapid growth and multiplication of saprophytic bacteria in the sedimented sewage liquors in the presence of an excess of dissolved oxygen, the rate of solution of oxygen from the air at the exposed surface of the liquors, and the rate and mechanism by which the dissolved oxygen is thence distributed through the unexposed portions of the liquors, are the controlling factors of the efficiency of the process. Experimental investigation has shown that the solution of oxygen from the air by water at its exposed surface does not remain concentrated at the the surface, as was up to quite recently believed, but sinks, as it is formed, towards the bottom layers of the water. The continuous downward "streaming" thus produced causes a corresponding upward displacement of unexposed portions of the water towards the surface, and sets up an imperceptible but efficient process of mechanical mixing of the exposed and unexposed portions of the water.

In salt water the "streaming" effect has a more rapid mixing effect. Having found that the re-oxygenation of sewage liquors, as they tend to become de-oxygenated during bio-chemical purification, is effected under natural conditions by the downward "streaming" of streamlets of re-oxygenated water from their exposed surfaces, it was necessary to determine the actual rate of solution of oxygen from the air by unit surface of interface air-water, "a vital datum for a knowledge of the self-purification powers of rivers or other waters." This problem was worked out by means of the narrow-bore tube and rising-bubble method, which the author describes with tabulated results. Experimental investigations have shown it may be safely assumed that the re-oxygenation by "streaming" of normal sewage liquors in aeration tanks may be effected at maximum rates if the areas of the tanks be properly proportioned relatively to their depth, and that the surface of the liquors be kept continuously disturbed during their flow through the tank; the rate of re-oxygenation being inversely proportional to the depth of the aeration tanks for a given condition of surface agitation. The method of agitation commonly employed in operating the activated sludge process, *bubbling* air through the liquor, is, apart from mechanical agitation, a very inefficient process. H. Home.

Reprinted from "Bulletin of Hygiene," Vol. 7, No. 11.

VOSS, J. A. Om variola og vaksinevirus. Paschens elementaerlegemer. **[Concerning Variola and Vaccine Virus. Paschen's Elementary Bodies.]** *Norsk. Mag. f. Laegevidenskapen.* 1932, v. 93, 875-7.

In 1907, Paschen of Hamburg demonstrated with the help of special staining methods certain small bodies, which he called elementary bodies, in vaccine pustules. These bodies are round and measure from 0·2 μ to 0·23 μ. They do not take the ordinary bacterial stains even after twenty-four to forty-eight hours. But they do colour on prolonged staining with Giemsa. They can always be found in variola and vaccine pustules, in vaccine lymph itself, in lapine, and in the rabbit's cornea infected with vaccine. Similar, but not quite identical, bodies can be demonstrated in varicella, but not in herpetic or other vesicles, nor in pustules which are not provoked by variola or vaccine.

Recent investigations have provided confirmatory evidence in support of Paschen's claim that his bodies are identical with the virus of vaccine. In conjunction with Nauck, Paschen has grown his virus in tissue cultures up to thirty generations, and after the twentieth generation animal tests have shown a marked increase of virulence running parallel with an increase in the number of Paschen's bodies. It may now be claimed for these bodies that: (1) they are always present in smallpox and cowpox; (2) that they are not present in other diseases; (3) they can be cultivated; and (4) the product of such cultivation can provoke the same disease in experimental animals. One objection can, however, still be raised. The growth may not be a pure culture; it is possible that there exists an invisible virus which has been able to propagate itself on tissue culture. It should be noted that in 1931 Ledingham confirmed the observation made in 1911 by Paschen and Jacobsthal that Paschen's bodies are agglutinated by variola immune serum. C. LILLINGSTON.

Reprinted from "Bulletin of Hygiene," Vol. 7, No. 11.

KOELZER, W. Ueber die Verminderung einer Schädigungsmöglichkeit durch die Pockenschutzimpfung ohne wesentliche Herabsetzung des Impfschutzes. **[On Reducing the Possibility of Injury from Vaccination without any Real Reduction in its Protective Value.]** *Deut. Med. Woch.*, 1932, v. 58, 1330-31.

The undesirable reactions which frequently occur after vaccination show the need for a milder form of vaccination technique, by which these reactions can be avoided, without, however, reducing either the degree or the duration of the immunity. It is preferable to reduce the number of incisions rather than to reduce the titre of the lymph. Experiments have have shown that vaccination by only one insertion, with lymph of adequate (minimum titre 1 : 1000), but not unnecessarily high virulence, invariably obviates any undesirable reactions, while giving the maximum effect. Vaccination with only one insertion must be repeated twice in the first ten years of life, once in the fifth year, about three and a half years after the

primary vaccination, and again in the ninth year. These revaccinations should be done with two insertions, as the results will probably be modified. Revaccination after twelve years (a third time) should be done with four insertions. This procedure will split up the severe vaccination illness of the first to second year into three mild forms spread over nine years.

O. K. WRIGHT.

Reprinted from "Bulletin of Hygiene," Vol. 7, No. 12.

TERBRÜGGEN, F. Ueber die Haltbarkeit des Maul- und Klauenseuche-virus in Milch und Molkereiprodukten. II. Mitteilung. Käse und Molken. **[The Persistence of the Virus of Foot and Mouth Disease in Milk and Milk Products.]**. *Deut. Tierarzt. Woch.* 1932, v. 40, 529-33.

The author records a series of observations on the persistence of the virus of foot-and-mouth disease during cheese manufacture. In Emmentaler cheese the virus is killed during the heating that forms part of the process of manufacture. In Neufchatel cheese and in sour-milk products the virus is killed by the markedly acid reaction that develops during the souring. In those cheeses, the making of which involves only slight heating of the milk (30-35° C.) and in which only a slightly acid reaction is allowed to develop, the virus may persist for a short time after the process is completed, and may be found in the curd or in the whey. Thus in Tilsit, Edam and Limburg cheeses the virus may be detected after periods varying from six to twenty-two hours. In Camembert cheese the virus may be found immediately the manufacture is completed, but not long after. The presence of the virus in the whey is of importance, since this is often used as food for susceptible animals.

There is no evidence that the virus ever persists in the cheese during the period of ripening which follows its initial manufacture.

W. W. C. TOPLEY.

Reprinted from "Bulletin of Hygiene," Vol. 7, No. 12.

Reviews.

RECENT ADVANCES IN PATHOLOGY. By Geoffrey Hadfield, M.D., F.R.C.P., and Lawrence Garrod, M.A., M.B., B.Ch., M.R.C.P.London. J. and A. Churchill. 1932. Pp. x + 392. 67 Illustrations. 15s. net.

This book will provide a useful companion volume to the "Recent Advances in Bacteriology," in the same well-known series. It is, perhaps, more selective in treatment, but on the other hand certain questions have been very fully considered. In their choice, the authors say they have been guided chiefly by the intrinsic importance of a particular subject or the extent of its illumination by recent work. Thus nephritis and pneumonia

the former of which is comprehensively reviewed, come in the first category; nephrosis and parathyroid adenoma, for instance, notwithstanding their comparative rarity, are included on account of the interest they derive from recent investigations.

Among other features to which attention may be particularly directed are the following: a concise and helpful account of the reticulo-endothelial system; the full summary given of the work on experimental cancer-research; the subject of cardiovascular disease; the consideration of the encephalitis problem, with special reference to the perivascular demyelination-type; and the latest view of the important part played by the adrenal cortex in Addison's disease. The numerous illustrations are a valuable asset; they are all on plate paper and constitute excellent photomicrographic reproductions, though here and there an example at a higher magnification would have been acceptable.

The treatment of the work is, in the main, didactic, and perhaps inevitably, considering that it relates to a large extent to questions upon which knowledge is ever-increasing at the present time, some statements are made with which not everyone will agree. Most of these refer, however, to small though not unimportant points. To give a few examples, for the sake of minor criticism. It is extremely unlikely that the macrophage, or a cell indistinguishable in appearance and function from the activated histiocyte, can be derived from the developed lymphocyte. Again, the statement that the individual cell, as such, is incapable of independent activity and multiplication is by no means warranted, when it is remembered how crude, relatively, tissue-culture methods still are as compared with the normal environment of any individual cell. Also, the used-up cells in which lie the clumps of "Encephalitozoon" bodies are almost certainly not distended macrophages, but nerve-cells.

There are also one or two major points in which the reviewer finds himself in disagreement with the authors. They definitely ascribe to the reticulo-endothelial system, as a normal function, the formation of the bile pigment. Muir, in his textbook of Pathology, sums up this question by saying that it does not follow that the experimental results (upon which such a conclusion is based) can be applied to the normal process of formation of bilirubin. There are, indeed, several weighty biological considerations against this view, though these cannot be discussed here. Again, in regard to the general question of immunity towards malignant growths, the account is not too clearly focused; this may well be because, in the light of our present knowledge, the evidence is to some extent self-contradictory. As regards the serological work on this subject, in the first place (not taking into consideration the stroma reaction) the reviewer is disinclined to credit the lymphocytic cell with the ability to acquire immunological properties; this is much more likely to be a function of cells of macrophagic type. And, secondly, the dubiety attached to Lumsden's important results (*vide* this Journal, October, 1932, p. 368 *et seq.*) is, to put it mildly,

very far from being justified, and altogether the authors' concluding remarks in this section do not accurately represent the position already gained.

But the book is good, notwithstanding the points which have been criticized above. Its merits and helpfulness will be readily apparent to readers; and to those concerned with, or interested in, the closely associated subjects of bacteriology and pathology, it should be a natural complement to the "Recent Advances in Bacteriology" upon their library shelves.

H. M. W.

DIPHTHERIA PAST AND PRESENT: ITS ÆTIOLOGY, DISTRIBUTION, TRANSMISSION AND PREVENTION. By J. Graham Forbes, M.D., F.R.C.P., D.P.H. London: Messrs. Bale, Sons and Danielsson, Ltd. 1932. Pp. xx + 832. Price 45s.

In a book of more than 800 pages Dr. Graham Forbes has brought together into one volume an enormous number of facts about diphtheria. His Milroy lectures delivered at the Royal College of Physicians in 1929 form the basis of the interesting material that the volume contains. The ætiology, distribution and transmission of the disease are each exhaustively dealt with; but it is on the subject of prevention that the book is remarkable, for here we have a host of facts from the reports of the Public Health Departments of almost every civilized country brought together and tabulated for the first time. Dr. Forbes gives his conclusions in two pages at the end of the volume. He is quite convinced, and few will disagree, that preventive inoculation is the only practical means of controlling diphtheria. Immunization is being more and more made use of, but it is not yet evident which is the best prophylactic to use. A prophylactic capable of reliable immunization by means of a single inoculation is, unfortunately, not yet available. The author is able to state that so far as diphtheria preventive work in Great Britain and Ireland has been concerned, in the Schick-testing and immunization of over 150,000 individuals of all ages, no known serious or harmful result has followed. The book contains a large number of charts, maps and diagrams, and there is an introductory note by the late Sir Frederick Andrewes, M.D., F.R.S.

A. C. H. G.

A SYSTEM OF SURGERY (in three volumes). Edited by C. C. Choyce, C.M.G., C.B.E., B.Sc., M.D., F.R.C.S. Pathological Editor, J. Martin Beattie, M.A., M.D., C.M., M.R.C.S. London: Cassell and Co., Ltd. 1932. Vol. I, 33 colour and 67 half-tone plates and 285 figs. in text. Pp. xxiv + 1112. Vol. II, 16 colour and 11 half-tone plates and 367 figs. in text. Pp. xv + 1111. Vol. III, 11 colour and 39 half-tone plates and 277 figs. in text. Pp. xvi + 1107. £6 net the three volumes.

It is now nine years since the second edition of this system was published in 1923. In this time considerable advances have been made

in surgery, and, owing to the death of some previous contributors and the fact that others are no longer on the active list, as many as fourteen new contributors are now included.

The System is very slightly larger in size and 29 new plates and 210 new illustrations have been added.

Volume I now contains chapters on Surgical Pathology, Tumours, Venereal Diseases, Diseases of the Skin and Subcutaneous Tissues, Diseases of the Breast, and General Surgery. Volumes II and III deal with Regional Surgery and Special Subjects.

There is a new chapter by the late Dr. G. E. Birkett on the surgical uses of radium—and a considerable amount of information on the treatment of malignant disease by irradiation can be found in the article on Tumours and on the surgery of the Tongue, Breast, Fractures, etc.

In the article on Hæmorrhage and Transfusion the statement is made that "a Universal donor can give blood to anyone without danger, and that if only Group IV donors are used, then the blood of the patient need not be tested." Surely this is very definitely contrary to the usual teaching?

The chapter on Burns and Scalds has been rewritten by Mr. A. J. Gardham, and now includes descriptions of X-ray and radium burns.

The chapter on Surgical Diseases caused by Animal Parasites, etc., has been revised by Professor A. K. Henry of Kasr-el-Aini Hospital, Cairo.

Many of the other sections have been revised by eminent surgeons noted for their special knowledge on these subjects.

The whole system has been revised and brought up to date; the illustrations and get-up are excellent; these three volumes can be safely said to represent adequately the present teaching of surgery in this country.

J. M. W.

Manipulative Surgery. By A. J. Blundell Bankart, M.A., M.Ch., F.R.C.S. London: Constable and Co., Ltd. 1932. Pp. xii + 150. 7s. 6d. net.

This is one of the series of Modern Surgical Monographs edited by G. Gordon-Taylor, O.B.E., M.A., F.R.C.S.

So much has been written lately about the methods of "Bone-setters," and it has been distinctly inferred that this is a subject about which very little is known or practised by the members of the medical profession, that it is a great pleasure to read a book on this aspect of surgery written by such an authority as Mr. Bankart.

The author states in the preface that the aim of the book is to give an account of some of the uses and abuses of manipulation in surgery, and also that he gives his own opinions on a number of subjects that are open to discussion.

The first chapter (36 pages) is of an introductory nature and deals

with a certain amount of anatomy and pathology, and also with the general principles of manipulation and its dangers and failures.

There are then chapters on the foot, the knee, the hip, sprains of muscles and tendons of the lower extremity, the spine and pelvis, the fingers, hand and wrist, the elbow and the shoulder, and finally a chapter on bonesetting and osteopathy. With osteopathy the author deals in no unmeasured terms. The illustrations are excellent and show the various manipulations employed with great clearness.

This book is very welcome and should be of great use to all those interested in the orthopædic branch of surgery.

J. M. W.

Notices.

BRITISH RED CROSS SOCIETY—LECTURES ON TROPICAL HYGIENE.

The British Red Cross Society will hold a Course of seven lectures and demonstrations on Tropical Hygiene, on Mondays, Wednesdays and Fridays, commencing on Friday, April 21, at 9, Chesham Street, Belgrave Square, S.W.1, at 5.30 p.m.

The Course will cover such questions as food, clothing, and medical and sanitary precautions necessary for health in hot countries.

The examination for the British Red Cross Society's certificate in Tropical Hygiene will be held on May 10.

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Original Communications.

SUN HEATING OF TENT-LINEN CANVAS AND OTHER MATERIALS.

BY MAJOR T. O. THOMPSON,
Royal Army Medical Corps.

AT the Army School of Hygiene a series of tests has been carried out on the heating effects of sunshine on tent materials and the consequent heating of the interior.

This work was carried out during the period April to August when weather conditions and other duties permitted. A most noticeable point in this connection is the paucity of suitable periods for sunshine experiments in an English summer. Days which are regarded as sunny days are frequently interrupted by clouds which prevent a continuous series of readings. In fact, there were only three really cloudless days such as one would expect to get in other countries when doing similar work.

When the work was commenced the literature available was examined and extracted. Later, as the work was carried on, valuable assistance and further literature was obtained from Miss Fishenden and Mr. O. Saunders, who work on allied subjects for the Department of Industrial Research.

It soon became evident that no advice could be truer or more to the point than that given by the late Sir William Leishman in a note on carrying out any research work. He advised that before commencing any piece of research work, the worker should go through, absorb and steep himself in the literature of the subject.

When commencing this series of tests, it appeared that there was very little literature bearing on the subject, but it gradually became obvious that part of the ground was covered by elementary physics and that practically

all the ground, with the possible exception of experiments on the tent material at present in use, had already been covered by the papers published during the past twenty years.

The present series of tests was therefore limited to the heat effects on tent material and possible changes by means of paints and other colourings.

In this paper there is very little that is new. An attempt is made to show how we can bring some improvement in temperature conditions inside tents and other similar dwellings. The results obtained in this series of tests have been amplified by drawing on the figures and results published elsewhere by Grabham [1], Fishenden and Saunders [2], Coblentz and others [3]. It will be noticed that in many cases the actual difference or reduction in temperature is not more than a matter of a very few degrees, but in conditions where men are living on the verge of the limits capable of being endured every additional disturbing factor is of the utmost importance, and the elimination or lessening of each disturbing factor may make all the difference between health and ill-health, between efficiency and the reverse, and may save useless expenditure.

Personal experience in two "hot" stations in India had shown what a marked reduction in temperature and saving for the personnel concerned could be achieved by a single coat of whitewash on the roof of a gunpark and on the roof of a large mechanical transport workshop. A decrease of 10° F. being obtained in the one case and 7° F. in the other.

The coolness of "whites" as compared with khaki or darker cloths is well known to all who have served abroad.

Ogilvie [4], in 1923, called attention to the need for investigation into the effects of heat absorption from roofs and tents with a view to increased efficiency and elimination of useless expense. Accordingly, the following experiments were carried out with the material and the apparatus described :—

A variety of white cloths, linen and wool, was obtained for trial in small sections, both uncoloured and when dyed or painted. Tent material, linen and cotton, both old and new, was received from Ordnance, and also the cotton Doosootie used for making marquees. Temperatures were recorded by direct readings from Centigrade thermometers placed in contact with the material or inside the special boxes to be described later. A thermopile apparatus not being available, a type of radiometer was devised from ordinary thermometers fixed into motor-car headlamp reflectors. A six-inch motor-car headlamp reflector was fixed in a special wooden stand so that the whole of the back was insulated by three-quarter inch wood. The thermometer was passed through the normal electric-bulb aperture so that the bulb of the thermometer was at the focal point for normal distant rays of light. The bulb of the thermometer was blackened with a black matt paint, i.e., lamp black and varnish, for maximum absorption of heat rays, but in the actual readings taken later the plain thermometer was used and contrasted with air temperatures.

This apparatus was found to be sufficiently satisfactory to give differential readings when placed facing differently coloured and treated materials. It is true, as pointed out by Saunders, that the rays from near objects would not be parallel and would not, therefore, be focused by the lamp as light would be; but it was thought that a sufficient proportion of heat rays would be parallel and would therefore be focused to give appreciable results, *vide* Table I. It may be mentioned that on one occasion one of these radiometers was accidentally exposed to direct sunlight for less than one minute, and the bulb of the thermometer burst.

Low Temperature Radiation.—A series of biscuit tins was painted with various colours, metallic paints, or polished, and filled with hot water at various temperatures so as to examine the emissivity of polished metallic surfaces for heat rays at those temperatures and the emissivity of paints, and also to test out the radiometers described above.

Medium Temperature Radiation.—A series of tests with an electric radiator (glowing red) was carried out for a variety of cloths during a period of poor weather conditions. According to Pouillet's scale of colour in relation to temperature, the temperature source would be about 800° C. (or 1,500° F.), and therefore the majority of heat rays would be of about the order of 3μ to 4μ. The results, therefore, might possibly be comparable to those from sunlight, although the short wave-lengths of solar radiation ($0{\cdot}95\mu$ to $0{\cdot}6\mu$) would not be in action.

POUILLET'S COLOUR SCALE OF TEMPERATURES OF HEATED OBJECTS.

	Degrees Fahrenheit	Degrees Centigrade
First visible red light	977	525
Dull red	1,292	700
Cherry	1,652	900
Dull orange	2,012	1,100
White	2,372	1,300
Dazzling white	2,732	1,500
Sunlight	14,000	5,600

For this purpose a frame of wood, covered with tinfoil and aluminium paints, was made in which a double layer of material could be fixed with a thermometer placed between the materials.

The whole was placed at an exactly measured distance from the front of the electric radiator, and by stop-watch the rise in temperature during a definite time was taken.

Subsequent cooling, when the frame was removed to another spot, was also recorded over a similar period.

Controls on air temperature and on the variations in temperature in front of the radiator were maintained by other thermometers, and the readings of the cloth temperatures were standardized from these.

For the comparison of colours cotton sheeting was washed, bleached, and dyed with Drummer dyes. With the white cloths the difference in

absorption appears to be due to fluffiness of the surface as compared with a smooth reflecting surface.

The results of the experiments are shown in Table I. The marked heating of the old tent linen is worth noting.

TABLE I.

CONSOLIDATED READINGS. COLOURED CLOTH. HEATING BY ELECTRIC RADIATOR.

	Heating. Temperatures at minutes					*Cooling.* Temperatures after minutes				
Cotton Sheeting	3	6	9	12	15	3	6	9	12	
Black	58	74	86	87	89	41	30	24	22	Sheeting washed [and dyed
Dark green ..	64	82	85	86	87	42	28	24	22	
Dark blue ..	61	77	81	82	84	41	28	23	22	Each figure is an average of 5 or more readings
Brown	62	74	78	79	81	39	27	23	22	
Dark yellow ..	61	76	79	80	81	42	28	23	32	
Grey	60	74	78	79	80	40	28	24	22	
Light green ..	58	73	77	79	80	41	28	24	22	
Light blue ..	59	74	78	79	80	40	28	24	22	
Plain white ..	61	74	78	79	80	41	30	24	22	
CONSOLIDATED READINGS. WHITE CLOTHS. HEATING BY ELECTRIC RADIATOR.										
Tent linen, old ..	66	83	91	93	93	46	33	25	24	Dark grey and [mildewed
Calico, new ..	66	79	83	86	87	42	28	23	21	
Flannelette, new ..	63	79	84	85	86	46	28	24	21	
Flannel, new ..	62	77	83	84	85	43	30	25	23	
Tent cotton, old ..	54	70	79	82	84	46	31	25	23	
Longcloth, new ..	61	78	80	81	83	40	28	23	22	
Twill cotton, new ..	63	78	81	81	82	38	26	22	21	
Tent linen, new ..	61	75	78	80	81	10	28	23	21	
Drill cotton, new ..	54	69	76	70	80	42	29	25	22	

Readings in degrees Centigrade.

Table II shows that the heating up by heat rays from this wave-length is similar to that from solar radiation on these same cloths.

TABLE II.—CLOTHS. SUN HEATING.

Cotton long cloth fixed in frame over box in single layer.

Thermometer (black bulb) placed in cavity of box about 1 inch below the cloth surface. Control formed by a single black bulb thermometer exposed to the sun in an open frame and giving readings approximately three degrees above prevailing air temperatures. Colours were obtained by dyeing washed long cloth with a common type of popular dye (Drummer dyes).

Colour	Temperature : above control
White (14) washed and bleached	12·5 degrees Centigrade
White (14) not washed or bleached	14·0 ,, ,,
Pale blue (14) (a very pale colour)	15·0 ,, ,,
Yellow (14)	16·0 ,, ,,
Orange (14)	16·5 ,, ,,
Pale green (6)	16·5 ,, ,,
Grey (14) (a pale grey)	17·0 ,, ,,
Dark green (14)	17·5 ,, ,,
Black (14) (a dark grey)	18·0 ,, ,,
Light brown (8), equivalent to tanning	18·5 ,, ,,
Brown (14), equivalent to tanning	19·0 ,, ,,
Dark blue (14)	19·5 ,, ,,

Note.—The differences are not nearly so marked as with metals or painted cloths, due probably to thinness of material.

The numbers of readings are given in brackets.

Extracts from the results of the experiments on sun heating by G. W. Grabham [1] are given in Table III.

TABLE III.—COMPARATIVE TABLE SHOWING SUN HEATING OF CLOTHS.

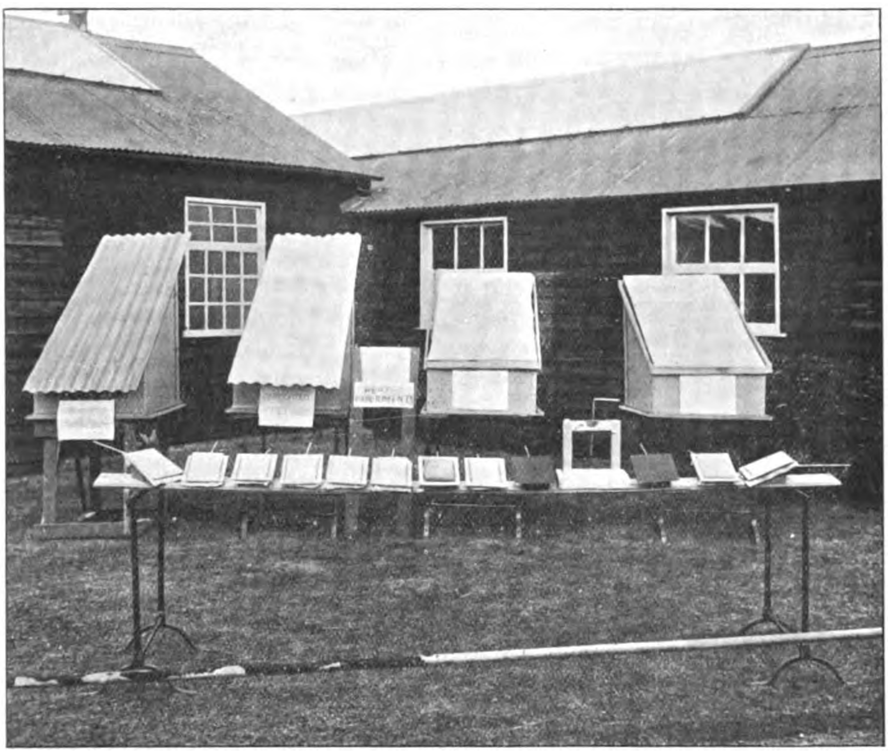
The cloths were laid on a white sheet and exposed to full sun with thermometer underneath.

Cloth	Maximum temperature Deg. C.	Freely exposed thermometer 45·2° C.
Black thin lining	85	
Black imitation serge	83	
Black serge	83	
Dark blue "Zerak"	72	
Khaki thick drill, washed	76	Actual temperatures
Khaki thick drill, new	75	observed in the Soudan
Khaki serge	76	
Khaki Solaro sun cloth	72	
Khaki Bedford cord	72	
Pale blue "Lobeni"	72	
White duck	61	
White drill, washed	59	
White drill, new	57	

EXPERIMENTS IN SMALL MODEL HUTS.

Four huts were made of an insulating wood, Donocona fibre board, 4 feet long, 2 feet wide and 3½ feet deep at one end, and 1 foot at the other, thus giving a sloping roof which could directly face the sun (see illustration).

A wooden frame was made to hold tent material over the top as required,



and a movable frame to hold the lamp radiometer in an required position underneath the material being tested.

Trap doors were placed in the bottom of each for access, but eventually it was found that readings could best be obtained by removing the back and taking direct readings with controls alongside the radiometer.

Corrugated iron sheets painted with different colours and washes were first used, and then sections of tent material of different kinds treated with paints and washes were examined. The results of the latter tests are given in Table IV.

Readings in each case were taken directly from the radiometer which was placed one inch below the material being examined, and compared with controls consisting of the air temperature, the temperature in each hut, and a black bulb thermometer in each hut.

TABLE IV.—RADIOMETER READINGS ABOVE AIR TEMPERATURE IN HUT.

Readings are given in degrees Centigrade and are the averages of a considerable number of observations.

		Degrees Centigrade	Remarks
Duck linen.	Plain, new	12·5	Unbleached
,, ,,	old	14·8	Serviceable but turning grey
,, ,,	Old mildewed	18·5	Unserviceable from condemned tent
Canvas, No. 3.	New	13·4	Unbleached
Cotton tent.	Plain, old	13·6	Still white but with small mildewed spots
Duck linen.	Plain / Whitewash	12·7	Washed but not bleached
,, ,,	Plain / Graphite	13·5	
,, ,,	White paint / Graphite	5·5	
,, ,,	White paint / Plain	1·5	
,, ,,	Whitewash / Plain	— 1·2 (below)	
,, ,,	Graphite / Plain	17·5	
,, ,,	Limewash / Graphite	2·2	
,, ,,	Whitewash / Graphite	— 1·5 (below	
,, ,,	Pink distemper / Plain	4·0	
,, ,,	Buff distemper / Plain	6·2	
,, ,,	Blue distemper / Plain	7·2	
,, ,,	Green distemper / Plain	7·7	

Note.—Plain / Whitewash means Plain linen with whitewash underneath.

Whitewash / Graphite means Linen with upper surface covered with whitewash and lower surface covered with graphite.

Readings were taken when the temperature was constant.

It will be noted that the new tent linen is the coolest of the untreated materials, that with age and discoloration there is a fifty per cent rise in heat transmission, and that treatment on the outer surface with any form of whitewash or common water distemper markedly reduced the heat received above.

EXPERIMENTS WITH SMALL WOODEN BOXES.

Twelve small wooden boxes (⅜-inch wood) were made 4 inches long by 8 inches broad by 2½ inches deep at the back and 1 inch deep at the front.

These were used with sheets of metal or tent materials and other cloths over the sloping surface and placed directly facing the sun.

For the cloth material light frames of 3-ply wood were made to hold the material tightly in place, and the thermometer was passed into the centre of the box through a hole in the higher or back wall, being held in place with plasticine. This gave a practically unventilated space to be heated up round the thermometer. For the metal plates the thermometer was fixed to the plate by plasticine so that the bulb was actually touching the metal, and the stem was held in a groove in the back wall by plasticine.

The results obtained are shown in Tables V, VI and VII.

In actual use the boxes were arranged on a single plank supported on trestles three feet above the ground, and as far as practicable away from other sources of radiant heat in a sheltered corner among the buildings. They were placed so that no shadow fell on the test material or the sides of the box, with the slope directly facing south (i.e., true south, and therefore with English summer time the true noon sun was at 1 p.m.) (see illustration, p. 325).

The size of the material was always such as to overlap the area of the upper surface sufficiently to prevent any direct sunshine reaching the sides of the box.

Numerous common paints and metallic paints, market types, and two specially-made types, and a new type of aluminium foil were tested.

Procedure.—The materials were prepared and huts and boxes placed in position, and quarter-hourly or half-hourly readings from all thermometers taken. Readings were to the nearest one-fifth degree Centigrade.

During cloudy periods either just before or at the time of the reading no reading was taken, and notes on the condition of clouds were kept for the period under test.

In each set of readings a black bulb thermometer was included as a control. This thermometer had the bulb painted with two coats of black matt paint and was kept untouched throughout the whole period. For test control the thermometer was fixed in a light wooden frame with a six-inch open space, the bulb being in the centre of the opening. The whole was placed on the plank with the wooden boxes and exposed to the south to direct sunlight and in no way shadowed.

The readings of this control thermometer were almost exactly three degrees above the air temperature during the sunshine periods.

In addition, a record of half-hourly air temperatures was very kindly supplied by the Meteorological Officer at the R.A.F. Meteorological Station at Farnborough (two miles away) and this was used as a further control.

Readings for each type of material or colour have been checked against the control of the period and the increase above (or below) the control shown. The whole set of these readings has then been averaged, and the results are set out in the Tables V, VI and VII as degrees above the control.

Experiments with Paints on Metal Surfaces.

Sheets of tin 6 inches by 7½ inches were used (Table V).—This series was to confirm previous work, and for comparison with the results already shown by Grabham, Coblentz, and others.

The short-wave radiation on to coloured surfaces demonstrates the coolness of the light paints compared with dark paints.

Table V.

Metals. Temperatures on Under Surface of Metals, compared with air temperatures.

Tin Plate. Upper surface covered. Under surface bare.

		Degrees above control given in Centigrade
	With water-washes	
	Whitewash (35)	1·0
	Limewash (5)	1·5
	Cement wash (10)	9·0
	Nothing, i.e., plain tin both sides (11)	4·5
	With paints	
1.	White paint (16)	3·0
	Pale yellow paint (14)	8·0
	Yellow paint (7)	9·0
2.	Orange paint (14)	10·5
	Red paint (23)	15·5
	Beige paint (12)	14·5
	Aluminium paint No. 1 (24)	15·0
	Light blue paint (5)	15·5
3.	Light green paint (7)	19·0
	Grey paint (9)	19·0
	Brown paint (7)	19·0
	Khaki paint (19)	19·5
	Tar (9)	20·0
	Dark blue paint (11)	21·5
	Dark green paint (19)	23·0
	Black paint (shiny) (19)	25·0
	Black, matt (lamp black)	29·0—30·0

Note.—Temperatures were taken by thermometers fixed against the under surface of the metal by plasticine.

The number of readings for each colour is shown in brackets.

For comparison the following results obtained by Grabham [1] in a series of experiments carried out at Halfa in the Soudan are given. Readings were obtained with thermometers placed in cylindrical metal flasks painted with various colours.

Colour	Degrees above the temperature with a whitewash covering		Maximum shade temp.
	Deg. F.	Deg. C.	
Black paint	36	20	
Black standard lamp black and varnish	35	20	40° C.
Green paint	30	17	
Brown paint	29	17	
Cement wash	26	15	
Grey paint	25	15	
Khaki paint	22	13	
Red paint	20	12	
Plain tin	19	11	
Scarlet	17	10	
Straw paint	13	8	
Green paint	11	7	
Cream enamel	11	7	
White enamel	6	4	
White standard	0	0	

Experiments with Untreated White Tent Fabrics.

Squares of tent fabric were fixed in the frames and placed over the boxes. In the case of the finer material there is probably a certain amount of ventilation through the cloth and also some element of direct penetration of sunlight. Temperatures were taken by a black bulb thermometer placed in the cavity of the box, one inch below the cloth surface, and the readings contrasted with a control black bulb thermometer exposed to the sun in an open frame giving readings approximately three degrees above the air temperature.

The results are shown in Table VI.

The marked rise in temperature under old as compared with new tentage is well brought out.

Table VI.

The number of readings on which the average is based is shown in brackets.

Plain Materials	Temp. above control Degrees Centigrade
Duck linen, new (83)	7·8
Duck linen, washed and bleached (9)	8·3
Willesden canvas, new (30)	10·0
Doosootie white, new (10)	10·9
Doosootie yellow, new (10)	11·9
Tent linen, old but serviceable (17)	12·8
Tent cotton, old (17)	13·4
Doosootie red, new (10)	14·6
Tent linen, old, dark, mildewed (17)	16·8

Note.—Duck linen is the modern material for *all* tents: cotton tents (new) are not now issued. The new duck linen has a smooth slightly shiny surface and is not really white but "pastel grey." Note the marked deterioration in protection from temperature in linen tents of which the material is old, grey or becoming unserviceable.

Doosootie is the common regulation cotton material used for marquees and hospital tents. It is used with three layers of "white" interlined with "red" or with "yellow." In this position the red or yellow is not exposed to direct sunlight but to the long-wave radiation under the outer covering.

Experiments with Tent Fabrics Treated with Washes and Paints.

The results are shown in Table VII.

In section (*a*) the wash or paint was applied *on the top* only and therefore indicates the heat absorption from short-wave radiation of sunlight with a constant under-surface of plain linen re-radiating the long wave adiation of cooler temperatures into the box cavity.

It will be seen that the results compare very closely with those in Table IV.

The difference between the paints and the distempers, apart from the colour or salt concerned, probably lies in the penetration of the material by the oils and driers and consequent occlusion of the inter-fibrillar spaces of the material and a greater transference of heat to the glazed lower surface.

In section (*b*) the application has been made on the under surface with the upper surface left plain. Therefore the short-wave solar radiation is absorbed by the plain linen (somewhat oil-glazed in the case of many of the paints) and the long-wave low-temperature radiation is emitted by the varying materials applied.

The relative similarity between all paint colours under the latter conditions is shown; but the high emissivity of the metallic paints and aluminium bronze is somewhat surprising, and is no doubt due to the amount of oil and varnish present which produces a non-conducting surface with high emissivity. This point is brought out by the differences in aluminum paints No. 1, 2 and 3. No. 1 is a stock commercial mixture. No. 2 was specially prepared by the paint suppliers on request for a paint with the minimum proportion of oils and varnish to the aluminium powder. No. 3 was specially prepared according to the formula given by Coblentz [3] with seventy-five per cent of aluminium in the paint. No. 2 undoubtedly appears to be the most effective.

Section (*c*).—A combination of the two previous methods using whitewash underneath, since this appeared to give one of the coolest results with the long-wave low-temperature emission of the under surface. It will be noted that there is a reduction of about two degrees in temperatures compared with the figures given in section (*a*).

TABLE VII.—TENT FABRICS TREATED WITH PAINTS AND WASHES.

The treated fabric was stretched over a frame on a box and the temperature recorded as in Table V.

Section	(*a*) Duck linen with paint or wash on top.	Temp. above control Degrees Centigrade
I.	Whitewash (31)	0·2
II.	Pale pink distemper (5)	5·5
	Pale blue distemper (5)	6·0
	Pale green distemper (5)	7·5
	Pale buff distemper (5)	8·5
	Yellow paint (17)	10·5
	Mottled paint (5). Pale yellow, pale blue and red on a white basis	12·0
III.	Aluminium paint (17)	12·5
	Lustra paint (35), a bronze paint	13·0
	Pale blue paint (17)	14·5
	Khaki paint (17)	15·0
	Dark green (17)	18·0

The distempers were the ordinary cheap colour washes having only a little size content. The paints were ordinary stock oil paints.

Section

(*b*) Duck linen with paint or wash underneath and a plain untouched surface exposed to the sun, to test the effect of various coloured surfaces on re-radiation from the heated surface.

Duck linen with paint or wash underneath	Deg. C. above the control
Pale pink distemper (5)	6·5
Pale blue distemper (5)	9·5
Whitewash (5)	10·5
Cream distemper (5)	10·5
Pale green distemper (5)	11·0
Aluminium paint No. 2 (40). Aluminium powder paint	11·5
Buff distemper (5)	11·5
Yellow paint (25)	12·0
Graphite wash (10)	12·5
Lustra paint (35). Bronze powder	13·0
Pale blue paint (5)	14·5
White paint (5)	15·0
Aluminium paint, No. 1 (40)	15·5
Aluminium paint, No. 3 (5)	15·5
Khaki paint (25)	16·0
Dark green paint (25)	16·5

Section

(*c*) Duck linen treated on both sides

Whitewash/whitewash (46)	−2·0	Below control
Whitewash/graphite wash (16)	−1·0	,,
White paint/whitewash (9)	4·5	Above control
Yellow paint/whitewash (10)	8·5	,,
Mottled paint/whitewash (9)	10·0	,,
Aluminium paint/whitewash (9)	12 0	,,
Pale blue paint/whitewash (9)	12·5	,,
Khaki paint/whitewash (9)	14·0	,,
Graphite/whitewash (3)	14 0	,,
Dark green paint/whitewash	15·0	,,

Section

(*d*) Metallic paints and foils on covering materials

Material and cover		Remarks
Duck linen, plain (38)	7·8	Temperature over control reading approx. 3 deg. above air temperature
Aluminium paint No. 1/plain linen (17)	12·5	
Aluminium paint No. 2/plain linen (40)	11·0	
Aluminium paint No. 3/plain linen (30)	15·5	
Lustra paint/plain linen (35)	13·0	
Canvas No. 3 plain (17)	9·0	
Aluminium paint No. 1/canvas plain (35)	8·0	
Aluminium paint No. 2/canvas plain (5)	7·0	
Tin sheet lamp black/aluminium paint No. 1 (10)	10·5	
Tin sheet lamp black/aluminium paint No. 2 (10)	9·0	
Alfol single sheet/frame and box (10)	−2 0	i.e., almost air temp.
Duck linen plain/Alfol single sheet (10)	3·4	Above control
Duck linen plain/3 layers crumpled Alfol/duck linen (10)	4·0	

Note.—Aluminium paints: for difference in composition see p. 330. Alfol: see p. 332.

Aluminium paint/black paint means the upper surface is painted with aluminium paint and the lower surface with black paint.

Graphite wash was tried because it was noted in the table of "emissivities" given by Fishenden and Saunders [2] that the "emissivity" was low for long-wave radiation, i.e., 41 per cent at 100° F. (9·3 μ) compared with 80 to 90 per cent for other substances used in paints, but no particular advantages seem to arise from its use, and it is a horribly messy stuff as an inner coating to any tent.

Section (*d*).—A comparison of the polished metal paints on tent linen, of canvas No. 3 which is used for hood coverings of ambulances and carts, and an impervious aluminium foil. This foil gave markedly cool results. It is sold under the name of "Alfol" by Alfol Insulation, Ltd., Windsor House, Victoria Street, S.W.1, to be used as an insulating material in three layers round boilers, disinfectors, etc. Its use as a lining or an underlayer of course completely shuts off ventilation through the material.

General Remarks.

For clarity it may be as well to give a brief summary of points bearing on the subject before considering whether this series of tests has produced any results.

Certain experiments in elementary physics are often forgotten and are worth recalling, and in fact in this case, I confess, were completely forgotten.

By placing coloured pieces of cloth on snow exposed to sunshine, Benjamin Franklin showed that the darker coloured cloths absorbed more heat and melted the snow beneath them.

Leslie and Melloni, and later many others, showed by numerous controlled experiments that up to a temperature of 100° C. almost any paint regardless of colour emits some 80 to 90 per cent of the absorbed heat.

Aluminium and similar metal-flake paints have more of the characteristics of polished metals depending on the amount and nature of the vehicle.

Table VIII.—Extracts showing Absorptivity or Emissivity of Various Substances. The Figures show *Percentages* of Full "Black Body" Radiation.

	24 μ	8·8 μ 125° F.	4·4 μ 750° F.	0·95 μ 5,000° F.	0·6 μ wave-lengths Solar temps.
Galvanized iron { Whitewashed ..	—	—	—	22	21
Galvanized iron { Ditto, new ..	—	—	—	67	66
Galvanized iron { Ditto, dirty ..	—	—	—	89	89
Lamp black	96	96	97	97	97
Blue Co_2O_3	94	87	86	97	97
Red Fe_2O_3	91	96	70	59	73
Green Cu_2O_3	92	95	67	55	73
Yellow PbO	90	74	49	—	48
Yellow PbO_4	93	95	59	—	30
White Al_2O_3	94	98	79	12	16
White ZnO_2	95	93	77	16	14
White $PbCO_3$	93	89	71	8	12
Aluminium, polished ..	4	4	5	26	—
Ditto, oxidized	—	11	12	18	—
Brass, polished	—	5	—	—	—
Steel, polished	—	8	12	37	45
Graphite	—	42	32	73	78
Oil paints	—	79	—	..	—
White paper	—	95	88	26	29
Cotton Cloth—					
Diamine red	—	—	—	—	57
Diamine black	—	—	—	—	67

Summary from the calculation of heat transmission by Margaret Fishenden and Owen Saunders.

Polished metal surfaces are good reflectors, i.e., low absorbers or emissers of radiation at low temperatures and high temperatures.

The wave-lengths of heat rays at different temperatures vary considerably and this is evident from the figures given at the head of Table VII. The absorptivity of various metals, salts and other surfaces likewise varies enormously as is shown by the extracts given in Table VIII.

The reflecting power of non-metal surfaces (excepting the silicates and some carbonates) is low, i.e., their absorptivity or emissivity is high at wave-lengths of about $4 - 9 - 24\mu$, that is temperatures between 30° to 100° C. which occur in roofs, tents and awnings.

White silicate paints radiate less than lead paints and should therefore be more suitable for under-surfaces of roofs [4].

Exhaustive experiments on clothing indicate a pronounced superiority of white linen or cotton fabrics over all types of khaki fabrics when exposed to sunlight.

In general it was found that the temperature of khaki fabrics when exposed to sunlight exceeded that of white drill by 13° to 36° F., while black fabric showed an excess of 54° F. over white drill [4].

Conclusions.

The ground has been practically covered before, and the present series confirms the findings of others. For tent and similar coverings the duck linen used for manufacture of tents is practically the coolest material which could be used and is superior in this respect to cotton fabrics.

Tanning or dyeing with any colour increases the heat absorption from the sun. Discoloration from age has a most marked effect in this respect and is a point well worth bearing in mind when considering the condemnation of tentage. If, in a spirit of economy, such discoloured tentage is retained, there will be an increase in the risks of heat absorption and consequently increased temperatures inside such tentage.

Painting of the exterior surface with any coloured paints increases the heat absorption. The coloured paints, khaki and dark green, most commonly used for motor ambulance hoods and other similar coverings, are the hottest paints, other than black, which can be employed. If painting must be carried out, then pale yellow paint or a patchwork paint of light colours, which absorb less heat than the darker colours, should be used.

If visibility is a question of importance, as it is with motor ambulances, then painting with light colours either in irregular patches or in some definite pattern on a ground of white silicate paint will give a decrease of some 6° to 10° in the heat absorbed from sunlight.

A series of trial patterns was made to test visibility, and it was found that certain combinations, even on white, are remarkably invisible.

Colour washing with distemper, particularly if used on old and

discoloured tent material, produces a definite lessening of solar absorption, and might well be employed for reducing internal temperatures.

Whitewashing and lime-washing produce the most marked result and temperatures below the control, i.e., only one degree above air temperature, were obtained even in closed boxes. The effect was most marked on old tentage. It is worth noting that even a small amount of whitewash will suffice. Tent material which had been washed with heavy rain still showed low absorption readings.

Whitewashing undoubtedly is the procedure to recommend for cooling. For the inner surface, when long-wave radiation comes into play, coloured paints are all much the same in the transmission of heat to the interior.

Whitewash, the pale coloured distempers, and metallic paints with a minimum of oil and varnish, offer the surfaces with the minimum transmission of heat. Paints of any kind occlude the ventilation through the material.

The coolest of all appears to be whitewash both inside and out, the inside temperature being practically the air shade temperature. A good aluminium paint is probably the next best for the inside surfaces.

The use of aluminium foil (Alfol) may hold out possibilities of cooling in marquees and hospital tents where ventilation through the material plays little part. It is a substance which could readily be inserted in place of the innermost Doosootie lining.

A factor which has not been tested out in this series, and is so often overlooked in recording results by thermometer or theromopile is the reaction of the human body to the conditions employed. An air temperature of 100° F., and over, as shown by the bright bulb of an air thermometer, affords little indication of the feelings of the human being exposed to and absorbing radiation from the surmounting walls and roof.

A test of living under the condition is required to ascertain the best results.

My thanks are due to Private A. F. Alderson, Royal Army Medical Corps, who has carried out much of the work in collecting the large number of readings necessary for these experiments.

In conclusion also I would thank Lieutenant-Colonel G. S. Wallace, O.B.E., Commandant of the Army School of Hygiene, for permission to forward this article for publication.

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AN INVESTIGATION INTO THE BACTERIAL POLLUTION OF SWIMMING BATHS.

With special reference to:—

(1) The normal bacterial flora, the pathogenic organisms present and their importance in relation to the spread of disease.

(2) The viability of certain micro-organisms, chiefly of the coli-typhoid-dysentery group, in fresh-water and sea-water.

(3) A study as to the presence of bacteriophage in fresh, sea, and sea-bath waters.

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Section I.

(*Continued from p.* 190.)

TABLES SHOWING THE MORPHOLOGY, BIOCHEMICAL AND OTHER REACTIONS OF ORGANISMS ISOLATED FROM SEA-WATER BATHING POOLS AFTER USE—*Continued.*

BATH-WATER SAMPLE. **F.**

No.	Nature of growth	Morphology	Reaction to Gram's stain	Biochemical reactions						Gelatin liqu.	Hæmolysis
				Glucose	Lactose	Saccharose	Mannite	Dulcite	Salicin		
1	Yellow	Staphylococcus	+	A	—	A	—	—		+	—
2	Brownish	Bacillus (capsulated) ..	—	—	—	—	—	—		+	—
3	Creamy white ..	Staphylococcus	+	A	—	A	—	—		+	—
4	Drab coloured ..	Streptococcus	—	—	—	—	—	—		—	—
5	White	Coccus (Staphylococcus)	—	—	—	—	—	—		—	—
6	Greyish white ..	Bacillus	—	—	—	—	—	—		—	—
7	Pink	Yeast	+	—	—	—	—	—		—	—
8	,, ...	,, ...	+	—	—	—	—	—		—	—
9	Dry wrinkled growth	Spore-bearing bacillus ..	+	—	—	—	—	—		—	—
10	Drab coloured ..	Diplococcus	—	—	—	—	—	—		—	—

BATH-WATER SAMPLE. G.

	No.	Nature of growth	Morphology	Reaction to Gram's stain	Biochemical reactions						Gelatin liqu.	Hæmolysis
					Glucose	Lactose	Saccharose	Mannite	Dulcite	Salicin		
	1	Colourless ..	Bacillus	—	—	—	—	—	—		—	—
	2	Whitish ..	Staphylococcus	+	A	—	A	—	—		+	—
	3	,, ..	Bacillus	—	A	A	A	—	—		—	+
	4	,, ..	,, ...	—	A	—	A	—	—		—	+
	5	,, ..	,, ...	+	A	—	A	—	—		—	—
Blood agar	5A	Colourless fine	Hæmolytic streptococcus	+	A	A	A	—	—	—	+	+
	6	Colourless dry	Bacillus	+	A	A	A	—	—		—	—
	7	Yellow ..	Staphylococcus	+	A	—	A	—	—		+	—
	8	Creamy ..	Bacillus	—	—	—	—	—	—		—	—
	9	White ..	Staphylococcus	+	A	—	A	—	—		+	—
	10	Orange ..	Coccus	—	A	A	A	—	—		—	—
	11	Brick red ..	Bacillus	—	—	—	—	—	—		—	—

BATH-WATER SAMPLE. H.

	No.	Nature of growth	Morphology	Reaction to Gram's stain	Biochemical reactions						Gelatin liqu.	Hæmolysis
					Glucose	Lactose	Saccharose	Mannite	Dulcite	Salicin		
Agar	1	Colourless fine	Hæmolytic streptococcus	+	A	A	A	—	—	—	+	+
Blood agar	1A	,, ,,	,, ,,	+	A	A	A	—	—	—	+	+
	2	Creamy white	Staphylococcus	+	A	—	A	—	—		+	—
	3	Drab coloured	Diplococcus	—	—	—	—	—	—		—	—
	4	Reddish brown	Bacillus	—	—	—	—	—	—		—	—
	5	Yellowish ..	Coccus	—	A	—	—	—	—		—	—
	6	Reddish brown	,, ...	—	—	—	—	—	—		—	—
	7	Brownish ..	Bacillus	—	A	—	—	—	—		+	—
	8	Whitish ..	,, ...	—	A	A	A	A	—		—	—
	9	Colourless ..	Coccus	—	—	—	—	—	—		—	—

BATH-WATER SAMPLE. I.

	No.	Nature of growth	Morphology	Reaction to Gram's stain	Biochemical reactions						Gelatin liqu.	Hæmolysis
					Glucose	Lactose	Saccharose	Mannite	Dulcite	Salicin		
Agar	1	Colourless fine	Hæmolytic streptococcus	+	A	A	A	—	—	—	+	+
Blood agar	1A	,, ,,	,, ,,	+	A	A	A	—	—	—	+	+
	2	Colourless ..	Coccus	—	—	—	—	—	—	—	—	—
	3	Reddish ..	,, ...	—	—	—	—	—	—	—	—	—
	4	Yellowish ..	Staphylococcus	+	A	—	A	—	—		+	—
	5	Drab colour	Diplococcus	—	—	—	—	—	—		—	—
	6	White ..	Staphylococcus	+	A	—	A	—	—		+	—
	7	Wrinkled growth	Aerobic spore-bearing bacillus	+	—	—	—	—	—		+	—

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Section II.

Viability of Pathogenic Organisms in Water.

Although a great deal of work has been done by various authors on the viability of the typhoid and colon bacilli in water there is very little on record of the viability of the following organisms: (*a*) *Bacterium paratyphosum* B. (*b*) *Bacterium dysenteriæ*, Flexner. (*c*) *Bacterium dysenteriæ*, Shiga. (*d*) *Bacterium dysenteriæ*, Sonne.

The experiments recorded were carried out in practically all cases with fresh water and very little is known concerning the viability of any of the three organisms in sea-water.

Résumé of Literature.

As already stated most of the work in the literature of this subject deals with the viability of *Bacterium typhosum* in water.

In 1889, Bream found that this organism would live in sterilized distilled water for 188 days, and a year later Freytag found that in concentrated salt solution the organism was alive at the end of five months.

In 1889, Glaxa found that when he took a two-days-old agar culture grown at 36° C. the organism was found present on the ninth day in sterilized sea-water; but when he took two drops of a broth culture eight days old at 36° C. the organism was present in large numbers in sterilized sea-water on the twenty-fifth day.

In 1887, Hochstetter used potato cultures grown for four to seven days with the temperature of the room at 36° C. Portions of the growth were mixed with sterilized distilled water, and inoculated into various waters, and kept at 12° to 15° C. He found that (*a*) in ordinary potable water the longest duration of life was seven days. (*b*) In distilled water it lived for five days. (*c*) In mineral waters the longest duration of life was five days. He further stated that he could detect no difference in the behaviour of cultures grown at different temperatures.

In 1887, Hueppe took the growth from potato cultures five days old,

and found that the bacilli lived for twenty to thirty days in ordinary sterilized potable water, the water being maintained at a temperature of 10° to 20° C.

In 1887, Kraus found that in unsterilized well water the bacillus was no longer demonstrable after five to seven days, and that in a very pure water in Munich it could not be found after seven days when kept at a temperature of 10·5° C.

In 1887, Maschek found that in the sterilized town water of Leitmeritz the bacillus when maintained in water at 18° to 22° C. could be found for from ten to eighty days.

In 1886, Meade Bolton found that when he took small quantities of growth from either agar slopes or gelatine cultures and mixed them with sterilized salt solution, and then mixed a few drops with ten cubic centimetres of the water under investigation, the organism lived for two to three days when maintained at 35° C. None was found after six to seven days.

In 1889, Mattei and Stagnitta found that the bacillus could survive in ordinary sterile drinking water for four days.

In 1889, Straus and Dubarry took one needle point of a potato culture of the bacillus and introduced it into ten cubic centimetres of the water under examination. They found that in sterilized drinking water the organism was viable after thirty-two to forty-three days, and in distilled water after thirty to thirty-five days, when maintained at 20° C.

In 1888, Uffelmann found that the bacillus was viable up to two weeks in unsterilized drinking water maintained at room temperature.

In 1886, Wolffhügel and Riedel found that when they introduced one needle point from a gelatine culture into fifty cubic centimetres of the water and kept this at a temperature of 18° to 22° C. the bacillus remained viable in sterilized drinking water for over thirty-two days, when they took the same quantity from a broth culture and kept it at a temperature of 15° to 20° C. it remained alive for fifteen days in distilled water.

The net results of these investigations are: (*a*) In sterilized water the bacilli will retain their vitality for long periods—at any rate up to one month. (*b*) In the work done on unsterilized waters, the investigations at this time produced no conclusive proof of the viability of the *Bact. typhosum*; in the light of modern knowledge the methods employed must be considered to be faulty. It must be remembered, however, in assessing the value of any of these early experiments, that the diagnostic characters at the time were neither clear-cut nor sufficient in the light of modern knowledge. Further, some of these organisms isolated may not have been typhoid bacilli at all, but allied organisms. Also, due to imperfect methods, it is quite possible that typhoid bacilli which were present were not recognized as such.

In 1894-1895, Klein found the *Bact. typhosum* after long periods (unnamed), in sterilized tap-water from London waters. In unsterilized tap-waters in glass flasks the bacillus was isolated in 0·1 cubic centimetre in

each of the three kinds of water used eighteen days from the start of the experiments. After thirty-six days it was found in one only of the three samples, and in forty-two days, it was not found in any of them. In sterilized water it was found to be alive for over eighty-five days. In this paper no account is given of the method of sterilization adopted, nor as to whether the typhoid bacilli found were subjected to biochemical and agglutination tests.

In 1894, Frankland investigated the viability of *Bact. typhosum* in Thames water, Loch Katrine water and in deep well water from the chalk, and found that:—

(1) In unsterilized Thames water it died in nine days.

(2) In sterilized Thames water it was found on the forty-eighth day.

(3) In unsterilized Loch Katrine water it was alive after seventeen to nineteen days at 6° to 8° C., but had died out by this time when kept at a temperature of 19° C.

(4) In sterilized Loch Katrine water the bacillus was alive at thirty-nine to fifty-one days.

(5) In deep well water it was alive after thirty-three days.

In 1904, Jordan, Russell and Zeit conducted three independent experiments. Zeit worked with Lake Michigan and Chicago River waters, Jordan on the water of Chicago Drainage Canal, and Russell on Illinois River water.

Fresh typhoid cultures were used in addition to the following: Enrichment and precipitation methods; solid Drigalski Conradi medium. Bile-salt agar, glucose lactose agar, and the special medium of Hiss were also used.

The experiments were carried out in glass receptacles and in celloidin or parchment sacs. The advantage claimed for this method was that it allowed for dialysable substances to pass in and out of the sacs.

The results of these experiments were as follows:—

(1) Lake Michigan tap-water (100 to 2,000 organisms per cubic centimetre), the bacilli were found alive in the water in glass vessels for seven days, but never longer. In the celloidin sacs placed in flowing tap-water, they were found alive up to seven days, and in one instance for eight days. When sterilized water was used in both glass vessels and sacs, the organisms were found alive for twenty-five days in glass vessels, for fifteen days in parchment sacs, and for fifteen days in celloidin sacs.

(2) In impure Chicago river water (germ content 1,500,000 organisms per cubic centimetre), they were found alive for only three to four days.

(3) In the case of the Chicago Drainage Canal (really a dilute sewage containing 4,000 to 6,000 colon bacilli, and 10,000 streptococci per cubic centimetre), from 600 to 8,000,000 typhoid bacilli were added to the unsterilized water in sacs. In twenty-seven of twenty-eight experiments no *Bact. typhosum* was found two days after inoculation. Three colonies on one plate were found in one experiment ten days after inoculation.

In Illinois River Water (content 60 to 500 germs per cubic centimetre) to which were added 500 to 20,000 *Bact. typhosum* per cubic centimetre in fourteen parchment sacs suspended in water, only once was the bacillus found ten days after inoculation.

These authors therefore assumed that the vast majority of typhoid bacilli introduced into the several waters studied, perished in three to four days, but that "it is theoretically possible that specially resistant cells may occur which are able to withstand for a longer period the hostile influences present in the water."

In 1904, Russell and Fuller re-investigated this question in view of the difference in these results. They used parchment, celloidin and agar sacs and a growth of the same cultures that had been used in the previous experiments; they found that the organisms lived for eight to ten days. This agreed with the experiments previously reported on Lake Michigan Water under the same experimental conditions. When typhoid bacilli were exposed directly to the action of sewage bacteria, then the duration of life was diminished and the longest period for which they were then found was three to five days. The notable thing about these experiments is their uniformity and their confirmation of the work of the previous experiments on the waters of Lake Michigan and the Chicago Drainage Canal.

In 1904, Whipple and Mayer brought forward evidence that the presence of dissolved oxygen in water is very important and enables the organism to live longer than when oxygen is absent.

In the series of experiments which follow later, I attempted to show that the quantity of water in which the organisms are kept is of importance, but that the action of dissolved oxygen is doubtful or of little influence, for it will be admitted that little dissolved oxygen can remain at the end of 170 to 180 days in a flask which originally contained only fifty cubic centimetres of water. According to some writers, the conditions under which typhoid bacilli gain access to water are of the utmost importance. They state that naked typhoid cultures, e.g., laboratory cultures, are more readily killed by disinfectants than those from fæces; and that it is unjustifiable from experiments with typhoid bacilli in cultures to deduce conclusions as to the bacilli in fæces.

In 1904, Frost made a study of the antagonism of certain saphrophytic bacteria to the typhoid bacillus. He used chiefly celloidin sacs attached to test tubes open at both ends. The interiors of the sacs contained media inoculated with typhoid bacilli. These were then suspended in water or broth inoculated with the material under observation.

Park and Williams state that the life of the typhoid bacillus in water is usually short, often not over forty-eight hours, and usually not over a week. They also state that the less the contamination of the water the longer the bacilli are apt to live.

Houston, in his work for the Metropolitan Water Board, found that

typhoid bacilli from a patient were less resistant to water than were laboratory cultures. In 13 experiments with "uncultivated" bacilli, he recovered the organisms after one week in 9 experiments, after two weeks in 3 experiments, and after three weeks in 1 experiment. The same strain of typhoid bacilli after cultivation for some time on bacteriological media usually survived in river water for about five weeks.

Further, Houston, in one series of experiments, added cultivated bacilli to raw river water stored in the laboratory in partially filled stoppered bottles. In these experiments he found that the vast majority of the bacilli had died in one week, but that a few specially resistant bacilli persisted for several weeks. An average seeding of 1,600,000 bacilli per cubic centimetre was used in 18 experiments, and at the end of the first week the average count was only 531 per cubic centimetre, a reduction of 99·9 per cent in one week. A few specially resistant bacilli persisted for several weeks, and their final extinction (as judged by inability to isolate them from 100 cubic centimetres of the water) only took place after nine weeks. These experiments were repeated on a large scale in the open air with two galvanized iron tanks, each containing 350 gallons of raw river water. To Tank I was added 1,460 millions of "uncultivated" typhoid bacilli contained in 197 cubic centimetres of a carrier's urine. To Tank II just under 160 millions of the same organism were added, but these were previously cultivated on media. After three weeks no typhoid bacilli could be found in ten cubic centimetres of water from the "uncultivated" tank, though they were easily isolated from one cubic centimetre of the "cultivated" tank. A further 200 millions of uncultivated bacilli were added to Tank I, and by the end of another week tests of 100 cubic centimetres from both tanks were negative. The temperature of the water in the tanks ranged from 34° to 54° F.

Horrocks worked with tap-water, which he contaminated with typhoid carrier urine and stools. In tap-water with added urine, typhoid bacilli lived usually for less than seven days, but on one occasion up to the tenth day; when fæces was added to the water they lived usually two days, but in one experiment for eleven days. When urine of a carrier was added to sterile water, typhoid bacilli survived for more than four months.

Wilson and Dickson added 18 cubic centimetres of a uniform emulsion of fæces of a chronic carrier and 50 cubic centimetres of urine of a transitory carrier to 60 litres of water in an earthen vessel sunk in the ground and protected from rain and sunlight by a wooden awning. The water was thus exposed to natural temperatures from 2° F. to 54° F. Five hundred to 3,000 cubic centimetres of water were taken for each test and evaporated at 37° C., the water being enriched with peptone and nutrose and an agent inhibitory to other organisms added. By this means these two observers showed the organisms to be viable at the end of twenty-three days.

A. M. M. Grierson, writing in the *American Journal of Hygiene*, 1930, states that he investigated the survival of laboratory cultures of certain

pathogenic organisms when added to tap-water and found that in unsterilized tap-water these organisms die within forty-eight hours, whereas in sterile tap-water they survive for a longer period. He found that staphylococci, hæmolytic streptococci, pneumococci and *Bact. typhosum* are demonstrable after 144 hours and *C. diphtheriæ* after 72 hours, but that meningococci and gonococci do not survive for more than 2½ hours at 22° C. He thinks that it is possible for even very delicate organisms when introduced into swimming-pool water to remain viable sufficiently long to cause infection.

The present series of experiments was therefore made with a view to finding out the maximum time that the organisms would live in sea-water and tap-water when inoculated into flasks and kept at 20° C. and 37° C. in incubators. The organisms used were freshly prepared cultures from organisms isolated from cases in the City Hospital, Aberdeen.

In many of the investigations recorded it was noticed that while many papers gave the length of time the organisms lived, there was no mention of biochemical and agglutination tests to prove that the organisms isolated from the water after inoculation were actually the original organisms inoculated. In the present experiments the organisms have been subjected to biochemical and agglutination tests where necessary before being accepted as the organism originally inoculated.

In carrying out these experiments great difficulty has been experienced in keeping the original flasks sterile over long periods. Reference to this will be made later in the text and reasons advanced for the contamination. The contamination of the original flasks has added very greatly to the amount of work involved and has meant in the three experiments carried out the making of between 5,000 and 6,000 plates in order to obtain the organisms in pure culture. The work has been carried on for a period of over fifteen months (whole-time work).

Experimental Work Carried Out at Aberdeen.

Experiments were carried out with the following organisms.

(1) *Staphylococcus aureus.*
(2) *Staph. albus.*
(3) *Streptococcus hæmolyticus.*
(4) Pneumococcus Type II.
(5) *Bacterium coli communis.*
(6) *Bact. typhosum.*
(7) *Bact. paratyphosum* B.
(8) *Bact. dysenteriæ*, Flexner.
(9) *Bact. dysenteriæ*, Shiga.
(10) *Bact. dysenteriæ*, Sonne.

Method Employed.—The samples of water were collected in sterile bottles, then filtered under pressure by the apparatus described in the section on Bacteriophage through a bacterial filter L 7 to remove the organisms.

This filtrate was tested for sterility by adding samples of it to broth tubes and incubating them for seven days. If these appeared sterile to the naked eye at the end of this period, small quantities (0·1 cubic centimetre) were then plated out and sterility was accepted when no growth was found on the plates.

Whenever possible fresh cultures of the above organisms from cases in the City Hospital were employed and agar slopes were inoculated from these cultures.

The subcultures were then tested by the usual routine methods, appropriate biochemical and agglutination tests being applied.

A series of flasks, one for each organism, was thoroughly autoclaved, and to these were added by means of sterile pipettes fifty cubic-centimetre samples of the filtrate from the tap-water and sea-water previously proved to be sterile.

Samples were drawn from these flasks and again tested for sterility by inoculation into broth tubes which were incubated for twenty-four hours.

The growth on the freshly prepared young agar slope cultures was now washed off with sterile tap-water or sea-water. Two cubic centimetres of this emulsion was added by means of a sterile pipette to each flask of sea-water and tap-water, and the flasks labelled, dated, and put away in the incubator.

Each of the two series of ten flasks was incubated at 20° C. and 37° C respectively.

Immediately after inoculation and before placing the flasks in the incubator 0·5 cubic centimetre of the sample of water + organisms was withdrawn from the flask and was placed in sterile broth tubes and incubated at 37° C.

These tubes were then submitted after twenty-four hours to the appropriate tests for the particular organism. If any of these gave doubtful results, then the whole process was repeated until it was proved that the flasks contained only the sample of the water plus the specific organism added, and that no contaminating organism was present.

All this having been done, two series of experiments were carried out with the whole series of ten organisms and a third series was carried out with organisms of the coli-typhoid group only.

First Series of Experiments.

Viability of the Organisms in Sea-water Only.

In this series of experiments the flasks were opened *daily*; 0·5 cubic centimetre of each sample was removed with a sterile pipette and introduced with sterile precautions into a broth tube. The broth tube plus the sample was then placed in the incubator at 37° C. for forty-eight hours. At the end of that time the samples were submitted to the usual bacteriological

tests for the identification of the specific organisms. In the case of the organisms of the coli-typhoid group, samples from the broth. tubes were taken by sterile pipettes and seeded into the following sugars: glucose, lactose, saccharose, mannite and dulcite, and in the case of the coli samples into milk and peptone water in addition. Further, from the original broth tubes agar slopes were inoculated for subsequent agglutination tests.

The sugar reactions were read the following morning, and the agglutinations from the agar slope cultures were carried out the same day. In cases of doubtful sugar reactions the tubes were incubated for a further twenty-four hours, and in the case of *Bacillus dysenteriæ*, Sonne, the sugars were kept in the incubator up to four days to demonstrate late lactose fermentation.

With all the organisms of this group the only criteria accepted as proof of the presence of the organism were correct sugar reaction and agglutination with specific sera.

Difficulties encountered in this Investigation.

The first difficulty encountered was obtaining a sterile filtrate, the test for sterility being absence of growth in broth after seven days incubation. As can be surmised, another difficulty was keeping the flasks and their contents sterile, and in actual practice this was found to be impossible in all cases. This is not surprising in view of the amount of handling that the samples underwent in the daily opening and removal of test samples throughout the whole of the investigation. Contamination was a more or less constant feature and the type of contaminating organism was not the type one would have normally expected. Reference to this question of contamination will be made later on in this paper. The result of this contamination was that from a comparatively early date in the investigation resort had to be made to plating, which added very considerably to the

TABLE OF THE RESULTS OF THE VIABILITY OF THE VARIOUS ORGANISMS IN THE FIRST SERIES OF EXPERIMENTS.

SEA-WATER.

Organism	Viability at 20° C.	Viability at 37° C.
1. *Staphylococcus albus*	22 days	23 days
2. *Staphylococcus aureus*	23 ,,	25 ,,
3. *Streptococcus hæmolyticus*	48 hours	48 hours
4. Pneumococcus Type II	48 ,,	48 ,,
5. *Bacterium coli communis*	*80 days	41 days
6. *Bacterium typhosum*	51 ,,	41 ,,
7. *Bacterium paratyphosum* B.	*70 ,,	41 ,,
8. *Bacterium dysenteriæ*, Flexner ..	38 ,,	34 ,,
9. *Bacterium dysenteriæ*, Shiga	25 ,,	25 ,,
10. *Bacterium dysenteriæ*, Sonne	46 ,,	41 ,,

* In the case of these two organisms the flasks were empty after these dates and no further samples were available.

amount of work, for it entailed not only plating but picking colonies from the plates and seeding them in sugars and putting them up on agar slopes for agglutination. This often involved picking from six to twelve colonies from each plate before one giving the correct sugar reactions and agglutination could be obtained.

Second Series of Experiments.

The Viability of the Organisms in Tap-water and Sea-water.

In this series of experiments the same procedure of preparing the cultures and the flasks was followed, except that certain other precautions were adopted. The flasks, in addition to the ordinary cotton-wool stoppers, were all covered with filter papers which had been previously sterilized, and were kept in position with elastic bands. The flasks, with the exception of those containing the cocci, were only opened at weekly intervals, and the very greatest precautions were adopted to ensure sterility, an assistant being employed to flame the mouths of the flasks before and after the sample was removed, and also to flame the broth tubes—in short, he was employed on all occasions where two persons could carry out the work better than one, and he was continually under supervision.

TABLE OF RESULTS IN THE SECOND SERIES OF EXPERIMENTS.

TAP-WATER.

Organism	Viability at 20° C.	Viability at 37° C.
1. *Staphylococcus albus*	19 days	20 days
2. *Staphylococcus aureus*	18 ,,	17 ,,
3. *Streptococcus hæmolyticus*	24 hours	24 hours
4. Pneumococcus Type II	24 ,,	24 ,,
5. *Bacterium coli communis*	175 days	150 days
6. *Bacterium typhosum*	133 ,,	133 ,,
7. *Bacterium paratyphosum* B	—	150 ,,
8. *Bacterium dysenteriæ*, Flexner ..	155 ,,	133 ,,
9. *Bacterium dysenteriæ*, Shiga	29 ,,	27 ,,
10. *Bacterium dysenteriæ*, Sonne	150 ,,	133 ,,

SEA-WATER.

Organism	Viability at 20° C.	Viability at 37° C.
1. *Staphylococcus albus*	18 days	20 days
2. *Staphylococcus aureus*	17 ,,	18 ,,
3. *Streptococcus hæmolyticus*	36 hours	48 hours
4. Pneumococcus Type II	Dead at 24 hours	24 ,,
5. *Bacterium coli communis*	175 days	133 days
6. *Bacterium typhosum*	119 ,,	119 ,,
7. *Bacterium paratyphosum* B	175 ,,	119 ,,
8. *Bacterium dysenteriæ*, Flexner ..	119 ,,	119 ,,
9. *Bacterium dysenteriæ*, Shiga	23 ,,	21 ,,
10. *Bacterium dysenteriæ*, Sonne	119 ,,	119 ,,

Despite all these precautions, contamination of the flasks again occurred very little later in the first series of experiments, and again the contamination was not of the type one would normally expect. Reference will be made to this later.

In this series of experiments, it will be noted that the organisms lived a great deal longer than in the previous experiments.

The flasks were again incubated at 20° C. and 37° C. as in the last experiments.

THIRD SERIES OF EXPERIMENTS.

The Viability of the Coli-Typhoid-Dysentery Group in Tap-water and Sea-water.

In this series of experiments still greater precautions were taken to prevent contamination.

The writer, on medical advice, was ordered away for a long sea voyage, and proceeded to Ceylon. Prior to departure, flasks were inoculated after testing both the cultures as to their purity, biochemical and agglutination reactions, and also the water after filtration for sterility. The flasks were prepared and inoculated as described in the first series of experiments.

Samples were taken from all the flasks after one day, one week, and two weeks' incubation, and proved biochemically, and by agglutination, to be correct.

At the end of this period these flasks, in addition to being plugged with cotton-wool, were covered with sterilized filter papers kept in position round the mouth of the flask by elastic bands. An additional precaution against their contamination was taken in this case; the flasks were also covered over the top of the sterile filter papers with lead foil, which was fixed on tightly and kept in position with elastic bands.

TABLES OF RESULTS IN THE THIRD SERIES OF EXPERIMENTS.

TAP-WATER.

Organism	Viability at 20° C.	Viability at 37° C.
1. *Bacterium coli communis* ..	Alive at 168 days ..	Alive at 168 days
2. *Bacterium typhosum*	,, ,, 168 ,, ..	Not alive after the 122nd day
3. *Bacterium paratyphosum* B ..	,, ,, 168 ,, ..	Alive at 168 days
*4. *Bacterium dysenteriæ*, Flexner ..	Not alive after the 122nd day	Not alive after the 122nd day
†5. *Bacterium dysenteriæ*, Shiga ..	Alive at 14 days, but not alive on the 122nd day	Alive at 14 days, but not alive on the 122nd day
6. *Bacterium dysenteriæ*, Sonne ..	Alive at 168 days ..	Alive at 168 days

* *Bacterium dysenteriæ*, Flexner, gave correct sugars and agglutinated on this day.

† The viability was not tested from the 14th day to the 122nd day, for the reason explained in the text.

SEA-WATER.

Organism	Viability at 20° C.	Viability at 37° C.
1. *Bacterium coli communis* ..	Alive at 168 days ..	Not alive after the 122nd day
2. *Bacterium typhosum*	,, ,, 141 ,, ..	Not alive after the 122nd day
3. *Bacterium paratyphosum* B ..	,, ,, 168 ,, ..	Alive at 168 days
*4. *Bacterium dysenteriæ*, Flexner ..	Not alive after the 122nd day	Not alive after the 122nd day
†5. *Bacterium dysenteriæ*, Shiga ..	Alive at 14 days, but not alive on the 122nd day	Alive at 14 days, but not alive on the 122nd day
6. *Bacterium dysenteriæ*, Sonne ..	Alive at 168 days ..	Alive at 168 days

* *Bacterium dysenteriæ*, Flexner, gave correct sugars and agglutinated on this day.

† The viability was not tested from the 14th day to the 122nd day, for the reason explained in the text.

Each series of flasks was then incubated at 20° C. and 37° C. as already described, but in this case they were left in the incubator untouched and unopened for a period of 122 days, during the absence of the writer.

They were opened and tested on the 122nd day by the same methods as described in Series I.

In this series the experimental work had to cease on the 168th day, to allow this paper to be submitted in time.

Reasons for Discrepancies of Results.

In the previous investigations carried out the discrepancies that have occurred in the results have been explained by various writers as follows:—

Many experiments have been carried out under highly artificial conditions, e.g. (*a*) Bacilli have been added to water in small bulk and then kept confined in vessels, e.g., flasks and bottles. (*b*) Conditions of light and movement have been entirely different to those that occur in Nature. (*c*) The competition which occurs in Nature with other organisms has not been present.

When water is naturally contaminated with typhoid bacilli the normal vehicle of infection is urine or fæces, either of a case or of a carrier, whereas in most of these experiments laboratory cultures which had been kept for some time and whose resistance may thus have been enhanced have been used.

The viability of the organism in Nature is probably influenced by the amount of organic matter added to the water by natural means, and this is absent or nearly so in artificial experiments.

Another factor is the individual resistance of the *Bacterium typhosum*.

Houston found that typhoid bacilli direct from the animal organism died much more rapidly in river water than those strains which were previously cultivated in the laboratory. In 13 experiments "uncultivated" typhoid bacilli could not be found after one week in 9 samples, after two

weeks in 3 experiments, and after three weeks in 1 experiment, yet the same microbe after cultivation usually lived five weeks.

There is a great difference in the quantity of dissolved oxygen present in the water under natural conditions and after storage of the same water in flasks for long periods.

It is admitted that many of these criticisms are just and carry a great deal of weight, but at the same time there is something to be said for the other side of the picture.

When fresh cultures from a case are added to such a small bulk of water (50 cubic centimetres) as was the case in these experiments, there appear to be present many factors inimical to the growth of the organisms. As a result of the process of filtration under pressure through a bacterial filter to which this water was subjected, there was removed from the water not only bacteria but also a large amount, if not all, of the organic matter and solid material of all kinds which might serve as food for the organisms. Further, it is possible that certain organisms were removed which might, in view of no proof to the contrary having been established, be helpful instead of harmful to the growth of the organism.

Further, particularly in the first series of experiments where definite quantities were removed daily for examination, the bulk of the fluid was being decreased daily, and therefore whatever material was present in the water and of possible value in keeping the organisms alive was also being reduced.

The amount of water into which the organism is being introduced is of importance as also is the rapidity of reduction of the amount. It would certainly appear to be of importance in these experiments, for if in the case of the coli-typhoid group the results of the time of viability in the second series of experiments are compared with those in the first series, it will be found that their longevity is constantly greater in the second series from which samples were only removed weekly than in the first series where the samples were removed daily.

Another factor that would appear to be important is the pH value of the water. It is well known that as regards media used for the cultivation of the organisms the pH value of the media is of great importance.

In the case of natural sea-water the pH value is 6·4, whereas the pH value of that water after storage for 144 days was found to be 6·8. This might conceivably be a factor inimical to the vitality of organisms in sea-water.

It has been argued that the temperature at which these organisms in water are stored is a factor of prime importance. In comparing the results obtained in these experiments this would not appear to be the case, for there is little difference in the longevity of the organisms kept over long periods at 20° C. and at 37° C.; at any rate, in both cases the length of life is very considerable and the actual variation does not show itself in some cases until well after four months of life.

Again, the organisms stored in flasks in incubators, especially in the third series of experiments, were under atmospheric conditions far from normal, and there could have been very little actual interchange of air, if any, in these flasks for the period of 122 days during which they were never opened. The flasks during the whole of that period were not only plugged with cotton-wool stoppers, but were covered with sterile filter papers kept in position by elastic bands and the whole again covered with lead-foil which was fixed tightly round the top of the flasks and again kept in position with rubber bands.

It would therefore appear that organisms from fresh cultures kept in flasks are also subject to many inimical conditions, some of which are at any rate apparently known and demonstrable and probably to many others that are unknown, and that therefore the criticisms levied as to the artificial methods used in these laboratory experiments are not quite so potent as might at first sight appear.

These experiments are believed to have a real value, for, to take one example, if it can be proved that an organism such as *Bact. paratyphosum* B can live for more than 175 days under laboratory conditions, then if that organism is introduced into ordinary water, especially, say, into underground tanks or is placed in any set of conditions more or less akin to those adopted in a laboratory, the organism must remain a source of potential danger for a much longer period than is at present thought possible.

The Contamination of the Flasks.

Taking into consideration the precautions adopted in order to keep the flasks sterile, it is difficult to conceive how they became contaminated, especially in the third series of experiments. It will be noted that in addition to cotton-wool stoppers, the flasks on this occasion were covered with sterile filter papers and also with lead-foil. These flasks on the three occasions they were opened—namely, at the end of the first day, the first week and the second week—were sterile except for the organism they were supposed to contain. They were then stored in the incubator for 122 days without any further interference. When they were opened at the end of this period, some of them were found to be contaminated by a Gram-negative organism morphologically like a *B. coli*, and not by *B. subtilis*, staphylococci or streptococci or any of the usual contaminating organisms.

It will be noted that in all three series of experiments, despite the most careful handling, and in the later experiments the employment of an assistant, these flasks became contaminated. This meant that instead of being able to isolate the organisms directly in pure culture, resort had to be made to plating, which increased the amount of work in the investigation enormously.

Considering the amount of care taken in the handling and the other means adopted to keep the flasks sterile, it would appear that there may be some other explanation of the contamination. It had been noted in

some of the earlier experiments after the water had been passed through the bacterial filter and samples of it removed and added to four broth tubes, that in some cases all the broth tubes remained sterile for three to four days and on the fifth day one of the four tubes would show growth. This was repeated again and again, and sometimes it was not until as late as the tenth to the twelfth day that one tube would show signs of growth.

It would therefore appear a reasonable explanation of this contamination of the flasks that whilst the water in the flasks may remain sterile for seven days, the length of time adopted as a test of its sterility before use, yet at some date much later on there may develop in it some organism which has, for some reason, been dormant during that period, either as some specially resistant form or as a spore or at any rate in some form which at that particular stage in its life history was incapable of growth, but when subjected to the temperature of an incubator (37° C.) for a sufficiently long period, it was then capable of reproducing itself. Whether this stage is due to some new form adopted by the organism in order to carry it over the unfavourable period due to its new and adverse environment, or whether it is that the organisms have definitely got a life-cycle and that one of the forms in which the organism occurs is such that it will pass through a bacterial filter and the cycle be completed only after a definite period under favourable conditions, is not at present known.

It is, however, definite that the contamination of these flasks was a constant factor throughout the investigation and was very different from anything that the writer has ever experienced in the process of culture and repeated subculture of other organisms over very long periods of time.

The possibility of leakage from the actual filter candle was definitely ruled out by the methods adopted.

Summary and Conclusions.

The viability of the various organisms referred to in the text has been investigated on three occasions over periods of 80 days, 175 days, and 168 days respectively.

The experiments have been carried out under laboratory conditions, but the cultures used have, whenever possible, been fresh cultures from cases in the City Hospital, Aberdeen.

It is believed that the organisms tested can live for a much greater period of time than has previously been stated, and should any of them be introduced into water they may remain sources of infection for much longer periods than has been hitherto thought possible.

Temperature, within the limits of these experiments, has little or no effect on the viability of the organisms, or at any rate its effect is not exercised for a very long period. On the other hand, the quantity of the water and the frequency of its removal has a very definite effect as shown by comparing the viability in Series I with that in Series II.

This work has been carried out primarily as a test of the longevity of these organisms in sea-water and to show that should they become introduced into sea-water swimming pools, say by a carrier, they may be a potential source of danger and therefore that in all swimming pools some method should be adopted to bring about sterilization of the water.

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(To be continued.)

THE "TULLE GRAS" TYPE OF DRESSING AND ITS VALUE IN SURGERY.

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The object of this article is to draw attention to a type of dressing, the merits of which—although well recognized in certain specialist branches of surgery—do not appear to be familiar to the general surgeon.

Types of Surgical Dressing in General Use.

Most surgical dressings in general use for application to cutaneous granulating surfaces may be divided into five classes:—

(A) Those having a considerable degree of antiseptic power, which are used in highly infected wounds, with the idea of destroying the organisms present. Such dressings are not employed to any extent at the present time because it is recognized that, in virtue of their destructive properties, they also act as deterrents to the regenerative tendencies of the living tissue itself.

(B) Those of a milder antiseptic nature, most of which act fundamentally by the liberation of nascent oxygen on the surface of the wound, thus assisting the natural reparative process of the body tissue. In this group may also be placed the milder forms of Group A above, which when used in proper strength are capable of dealing with mild degrees of infection, but are not sufficiently powerful to cause much damage to the living body tissue. Also the "dye" antiseptics, such as brilliant green, which seem actually to have a stimulant action on growing cells whilst possessing a destructive power towards micro-organisms.

(C) Those which act by virtue of their hygroscopic power, such as "salt-packs," magnesium sulphate paste, and glycerine. These produce an outpouring of serum with a high antibody content from the wound surface, and cause very little damage to the regenerating tissue-cells.

(D) Those which are used merely as protective dressings on an aseptic, granulating surface.

(E) Those which are used as stimulants either to the formation of granulation tissue, such as lotio rubra, or to the epithelialization of the surface, such as scarlet red.

All these types of dressing have proved valuable in practice when used after careful consideration of the condition of the wound and the results which it is desired to obtain, but in many cases they are far from ideal. Until the introduction of the "Tulle Gras" dressing the difficulty has always been to provide a dressing of a protective nature—when once the

major degree of infection of the wound has been overcome—which will possess the following properties :—

(1) Mild antiseptic powers, and thus prevent accidental infection of the healing surface, without causing damage to the living tissue.

(2) Act as a stimulant to the growing epithelium.

(3) Be easily removable without adhering to the granulating surface: since the removal of a "stuck" dressing not only causes unnecessary pain to the patient, but on each occasion on which it is performed invariably means the avulsion of delicate, growing epithelial cells. Such recurrent traumata cause a definite increase of scar tissue growth in the wound, with a corresponding increase of unsightliness in the resultant scar.

(4) Allow the free escape of serous or purulent discharge from the granulating surface, the damming back of which always tends to encourage the growth of any organisms present.

Many forms of dressing have been elaborated in the past in an attempt to find one which will embody all the above points, but without complete success. The usual dressings employed by the general surgeon at the present time for such purposes are mixtures or emulsions of liquid paraffin with a mild antiseptic such as flavine (1 : 1,000) or eusol; but these are far from fulfilling all the conditions specified. In the form in which they are generally used they often act as a dam, effectively preventing the escape of discharge from the wound. They frequently stick to the granulating surface, their removal causing both pain to the patient and trauma to the growing tissue cells. Moreover, the bleeding which occurs on the removal of such an adherent dressing tends both to increase the tendency of future dressings to adhere to the wound, and to retard the natural regenerative tissue processes. Also it has been definitely proved experimentally that liquid paraffin and such substances, when present in sufficient quantities to prevent adhesion of a gauze dressing to the wound surface, cause a small but decided degree of retardation of tissue growth.

These disadvantages, inherent in such types of dressing, remained unrelieved till the introduction of the "Tulle Gras" dressing a few years ago.

The "Tulle Gras" Dressing.

This dressing was first placed on the market under the name of "Tulle Gras" by a French firm some years ago. It consists essentially of a fairly large-mesh gauze net, impregnated with vaseline containing 1 per cent. of balsam of Peru, supplied in sections about four inches by five inches in size.

The method of application of the dressing is as follows :—From the sections an area of dressing is cut, slightly larger in size than the area of the wound—or several whole pieces may be used together in wounds of large surface area—and this is placed in contact with the actual granulating surface. Over this is then placed a covering dressing, either of dry gauze

or of the particular mild antiseptic dressing which the surgeon favours, according to the state of the wound surface. Any discharge from the wound obtains free drainage into the covering dressing through the holes in the net and is absorbed. Thus the immediate neighbourhood of the granulating surface is kept clean, and the contaminated covering dressing only comes into contact with a small proportion of the wound surface. Owing to the impregnation of the gauze net with vaseline the dressing is almost entirely non-adhesive, thus enabling it to be changed whenever necessary with the minimum of disturbance to the healing surface and of pain to the patient. Moreover, the presence of the balsam of Peru not only acts as a mild antiseptic, but has a definite stimulant effect on tissue growth.

Thus it will be seen that this type of dressing completely fulfils all the conditions specified. Also, owing to its property of allowing free drainage, the dressing may be left in position for several days at a time, the covering dressing being changed only when considered necessary, thus still further minimizing the results of trauma on the reparative processes occurring in the wound.

Since the type of case to which such dressings are particularly beneficial is that with a large cutaneous granulating surface—e.g., that following the separation of sloughs after severe burns, etc.—it is obvious that they are specially useful in plastic surgery where a minimum of scar tissue is essential for the best results ; and they have, in fact, been employed very extensively in such cases by many operators in this field of surgery.

Treatment by this method has been proved quite conclusively to reduce the time taken for epithelialization of large granulating surfaces by some 10 per cent.

Variations of the Original "Tulle Gras" Dressing.

The original proprietary preparation is, however, sufficiently expensive to prohibit its extensive use among patients of the hospital class. Also, although the results given by it showed a definite improvement over all types of surgical dressing previously employed, some of the wounds on which it was used progressed less rapidly than others. It is obvious that it is unreasonable to expect a single type of dressing to produce uniformly good results when applied indiscriminately to all of the various conditions which may be present in a cutaneous granulating surface. Some wounds may need a strongly antiseptic application whilst others require a dressing to stimulate the growth of granulation tissue, without which there can be no hope of rapid epithelialization.

Now although such minor alterations may be effected by varying the type of covering dressing, it was considered that better results might be obtained by impregnating the net itself with the particular substances required. In this way the substances would be kept in closer apposition to the healing surface, whilst maintaining all the advantages of the original

dressing; and a variety of dressings could be kept on hand to meet the various conditions of the wound which might be encountered. Moreover, such dressings can be made in the hospital dispensary itself, since they call for little technical ability on the part of the staff; they are relatively inexpensive to produce, enabling them to be used more extensively than would be possible with the more costly proprietary preparation.

Consequently a number of impregnating substances were experimented with, and the resulting dressings tested on various cases. The following three types of dressing were found to be the most satisfactory, and have been employed with excellent results in the treatment of a large number of cases at the Metropolitan Hospital, London, and also in the Queen Alexandra Military Hospital, Millbank.

Type 1.—Owing to the fact that the balsam of Peru, incorporated in the proprietary preparation, did not give very good results in the presence of more than a moderate degree of sepsis, search was made for an alternative antiseptic for impregnation in the dressing. The "dye" antiseptic "brilliant green" has been found to possess a bactericidal power *in vivo* considerably greater than most other antiseptics of corresponding "phenol strength," and appears to have in addition a definite stimulant action on growing tissue cells. Hence it was thought that it might give superior results to those obtained with the original dressing. This supposition was borne out in practice—the "brilliant green" giving definitely better results than any other antiseptic tried. So that a standard dressing for general use was prepared in which 0·2 per cent. of "brilliant green" was substituted for the balsam of Peru in the proprietary preparation.

Type 2.—It has frequently been observed clinically that granulating surfaces which show but slow tissue growth with the continued application of a single type of stimulant dressing, will often react more rapidly if treated alternatively with different stimulants. From this point of view a dressing containing 0·5 per cent of scarlet red was prepared, and proved most satisfactory in use. The application of this dressing alternately with the brilliant green dressing has resulted in a marked quickening of tissue growth in such cases. Owing to the lower antiseptic properties of scarlet red, the strength employed is slightly greater than that of the brilliant green in Type 1 dressing, and a small proportion of tricresol and chlorobutal have been added as an additional means of increasing antiseptic action. Moreover, for some unexplained reason, this type of dressing is more satisfactory in the case of surfaces with a fair amount of necrotic tissue than is Type 1 dressing, and seems to aid in the separation of small superficial sloughs.

Type 3.—For many years, one of the most popular solutions for stimulating the growth of granulation tissue has been lotio rubra, containing zinc sulphate as its active element. Difficulties as regards the solubility of this substance made it impossible to prepare a dressing of the "Tulle Gras" type containing it, but other salts of this metal were tried—

the acetate giving the best results. Brilliant green is also incorporated in this dressing, with the idea of providing an additional stimulant action. This type of dressing gives superior results to those obtained from Types 1 and 2 where stimulation of granulation tissue particularly is required.

Practical Indications for the Use of these Dressings.

The following are the main points in the condition of the wound which call for the application of one of these three types of dressing:—

(A) Where the granulating surface is aseptic, or moderately so, and for general use, Type 1.

(B) Where rather more infection is present, or where there is a fair amount of superficial necrotic tissue, Type 2.

(C) Where tissue reaction is slow with the application of either Type 1 or Type 2 dressing alone they should be used alternately, being changed over every few days.

(D) Where stimulation of granulation tissue is necessary before epithelialization can occur, Type 3. In this type of dressing, care must be taken to cut it to the exact size of the granulating surface, as the zinc salt in the dressing will cause dermatitis and multiple pin-point ulcers if allowed to remain in contact for any length of time with the healthy skin surrounding the wound.

The covering dressing, whichever type of "Tulle Gras" dressing be employed, may be varied in accordance with the tastes of the particular surgeon, but as a general rule a simple dry gauze dressing gives as good results as any. If a temporary increase of antiseptic power be considered necessary, a good covering dressing is gauze soaked in eusol, which has been found to give good results in combination with all three types of "Tulle Gras."

Preparation of the Dressings.

The prescriptions for the antiseptic portion of the three types of dressing are as follows:—

(1)	℞	Brilliant green	..	0·2 per cent.
(2)	℞	Scarlet red	..	0·5 per cent.
		Tricresol ..	..	0·5 per cent.
		Chlorobutal	..	2·0 per cent.
(3)	℞	Zinc acetate	..	2·0 per cent.
		Brilliant green	..	0·2 per cent.

The base is the same in all three types:—

℞	Liquid paraffin	..	10 parts
	Paraffin mol. flav.	..	90 parts

The best material to use for the actual dressing is window-curtain net, with holes one-eighth of an inch in diameter. If, however, it is not possible to obtain a supply of this material, ordinary wide-mesh plaster-bandage muslin makes an efficient substitute.

The material must first be washed *thoroughly* to remove all the

"dressing" in it—at least two washings are necessary to do this properly. It is then cut into sections of a convenient size—about five inches by four inches will be found most suitable for general use. These sections are then sterilized in the autoclave.

The substances with which it is desired to impregnate the dressing are then dissolved in spiritus vini meth. and the sections of net are placed in the solution, where they are left for an hour. They are then removed and allowed to dry off slowly; too high a temperature must not be used in the case of dressings of Types 2 and 3, or chemical decomposition will occur.

The base is then melted, well mixed, and sterilized. A metal container is procured, about an inch larger both ways than the square of net. It must be provided with a well-fitting lid, and should be deep enough to contain a pile of from thirty to forty pieces of the dressing. The sections of net are then placed in a pile in the tin alternately with pieces of thin paper cut to the same size. Interleaving the pieces of dressing with paper is to prevent them sticking together after impregnation with the vaseline base.

The melted and sterilized base is next poured into the tin until it covers the top of the dressings in the container. The container and its contents are then kept at a temperature slightly above the melting point of the base for two hours. At the end of this time the base will have satisfactorily impregnated the dressing, and the surplus may be poured away.

The container is then closed, sealed with adhesive plaster round the lid and autoclaved for twenty minutes. No holes should be present in the container, as exposure to steam in the autoclave will destroy the dressing. The dressing is then ready for use.

If care is taken to remove only a single sheet of dressing at a time, and to do so with a sterile pair of forceps, the tin and its contents will remain completely sterile for some time, owing to the antiseptic incorporated in the dressing. But of course it may easily be resterilized in the autoclave whenever considered necessary.

It will be seen from the above description that these dressings are quite inexpensive to prepare. The only costly ingredients are the dyes, and the solutions of these in methylated spirit can be kept and used again several times, though it must be remembered that each time it is used the solution will become slightly weaker.

Practical Points in the Use of these Dressings.

The following are a few practical points about the use of these dressings which may be found of value :—

(1) When placing the dressings on the granulating surface, always make sure that they are in close contact with the wound, as otherwise the best results will not be obtained. This may be done by gently smoothing them down with the finger-tip, when they will adhere closely to the contour of the wound.

(2) The usual period to leave such dressings unchanged is three to four days, but this may have to be varied according to the condition of the wound. They should always be changed when the dye has disappeared from the portion of the dressing in contact with the granulating surface.

(3) If correctly prepared, the dressings will be found to stick slightly to the surface of the wound, so that they will be left in correct position when the covering dressings are removed. If, however, they come away with the covering dressing, the epithelializing surface will not be injured in any way, and they may be replaced as before.

(4) If the dressings adhere to the wound and have to be torn off, they are either not being prepared correctly or have been left in position too long.

In conclusion, I wish to thank Mr. F. W. Hooper, Chief Pharmacist to the Metropolitan Hospital, for his invaluable assistance in the evolution of these dressings and for his help with the details of their preparation.

SOME OBSERVATIONS ON THE INFECTIVITY OF WISDOM TEETH.

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Lower wisdom teeth, which are the last teeth to erupt, are frequently a source of ill-health. Many people succeed in cutting their wisdom teeth without much trouble, but it is not uncommon for an erupting wisdom to give rise to inflammatory symptoms which may endanger the life of the patient if treatment is not prompt.

A large number of wisdoms, for one reason or another, fail to erupt, and various pathological conditions have been ascribed to the presence of such impacted teeth. The associated symptoms are best considered in two main groups, namely: (1) local; (2) general.

(1) Local symptoms. The patient may complain of neuralgia on the affected side. Such a pain, although it may always be present, is subject to acute exacerbations every few months. This condition is ascribed to the attempt of the misplaced tooth to erupt. The pain is generally referred to the third division of the fifth nerve, but is sometimes in the area of distribution of the other divisions. Earache is a very frequent symptom which may prove misleading if the presence of an impacted wisdom has not been suspected. Pain, which may be acute, is often felt in other teeth, and this may lead to the diagnosis of an acute abscess in connection with a sound tooth. Yet another symptom is persistent headache, and the exact relationship, in this case, is still a matter of conjecture. The headache may be produced by irritation of the nerve as the result of eruptive pressure, or by tissue absorption.

(2) General symptoms. General ill-health may result from impacted teeth, and other conditions associated with them are migraine, insomnia and mental disease. Various ocular diseases of an infective origin have also been traced to exerupted wisdom teeth. The fact that general symptoms do occur has given rise to a belief in the minds of many clinical observers that the pathology of wisdom teeth is not sufficiently understood to enable the problem of the resulting incapacity to be approached in a rational manner.

This problem is important as it arises at an early age and, if not dealt with, persists throughout the life of the individual.

Sufferers from the ill-effects of wisdom teeth may be arranged in three main groups, namely:—

(1) Those who suffer as the result of an attempt by the tooth to erupt.

This group contains two sub-groups: (*a*) those who suffer from sensory disturbances and referred pain in the branches of the trigeminal nerve, and (*b*) those who suffer from acute inflammatory changes as the result of the partial eruption of the tooth giving rise to stagnation areas which allow of the development of pyogenic organisms. This condition, if neglected, may lead to the death of the patient.

(2) Those who suffer from such conditions as migraine, headache, insomnia and mental instability. This group is composed of patients who have passed the period of effort to erupt on the part of the wisdom teeth.

(3) The third group is composed of elderly patients whose teeth have either become the centre of a cyst or have become uncovered as the result of gingival recession. In this case the individual is liable to suffer from acute pyogenic infection in connection with the unerupted tooth, and such infection, if not treated, may lead to conditions similar to those in Group 1. Chronic localized inflammation may develop, and it is in these people that a discharging sinus may sometimes be seen on the outside of the face.

It will be readily seen that there are some very important gaps in our knowledge of wisdom teeth in their relation to general disease. It is difficult to understand how unerupted teeth, not giving rise to local symptoms, can be associated with the production of general disability unless there is some other factor in addition to the uneruption of the tooth. The suggestion has been frequently put forward by clinical observers that the unerupted tooth may be a source of focal infection, but this up to the present has not been proved, owing to the difficulty of evolving a satisfactory laboratory technique in which all possibility of contamination is eliminated.

Working in conjunction with Mr. A. H. Walters at the Royal Albert Dock Hospital the writer has evolved a technique which, while simple, does, in his opinion, entirely eliminate the danger of contamination, and makes it possible to investigate the bacteriology of impacted teeth with ease. This technique was described in a recent issue of "Oral Topics."

Technique.

The method employed in removing the teeth to be investigated was the so-called Surgical Method in which a flap of gum is turned down on the outer side, and the obstructing bone removed so as to allow the tooth to be lifted out without damaging the surrounding structure. By this method, also, it is possible to remove all diseased bone, and to be certain that no fragments of tooth remain.

A large proportion of the wisdom teeth removed require amputation of the crown with the consequent opening of the pulp chamber, and this makes contamination certain. The investigation has been restricted, therefore, to those cases in which the tooth was removed complete.

Each tooth on removal was placed in a dish of ether and left for one minute. It was then enclosed in a sterile tube and sent to the laboratory.

It was next immersed in methylated spirits for two minutes, and then

in two changes of ether for one minute, and after ether it was placed in a sterile Petri dish and put to dry in an incubator at 37° C. for ten minutes.

From the first Petri dish the tooth was removed with sterile forceps to a second sterile Petri dish and control cultures on blood agar and in glucose broth were made from the crown and root. These cultures were incubated at 37° C. for seventy-two hours.

The tooth was then removed by means of sterile forceps and placed between the folds of sterile gauze, thus allowing the tooth to be lifted up by means of the free ends of gauze. A No. 91 Ash's splitting forceps was fitted over the tooth which was split by steady pressure.

The gauze was then unfolded and removed to a sterile Petri dish and the pulp was dissected out with the help of sterile scalpels and forceps.

The pulp was placed in a third sterile Petri dish and was cut into three equal pieces. The first portion was used for inoculating tubes of blood agar and glucose broth, which were incubated under aerobic conditions at 37° C. The second portion was used in the same way, but the tubes were incubated at 37° C. under anærobic conditions. Two direct smears were made from the third portion, one being stained by Gram's method, and the other with Leishman stain.

The number of cases examined has as yet been small, but the results are so interesting that they are worth recording. It was felt that it would not be wise to confine the investigation simply to impacted wisdom teeth, but that the results would be of greater interest and importance if all impacted teeth were included, and when 50 or 100 cases have been investigated it will be easier to draw conclusions of clinical importance.

Case 1.—Girl, aged 18; impacted upper premolar, lingual cusp just showing, causing ulceration of tongue; pulp dry, normal appearances. Culture sterile.

Case 2.—Partly erupted wisdom tooth in patient, aged 40, complaining of neuralgia in lower jaw; pulp dry, normal appearance. Culture sterile.

Case 3.—Patient, aged 24; pain and difficulty in opening jaw; some swelling of surrounding tissues; trismus; pus present on buccal side; pulp swollen and slightly moist. Direct smear showed a few polymorphs. No micro-organisms were seen. Aerobic cultures in glucose broth gave growth of *Streptococcus longus*. Subculture on solid media failed to reveal hæmolysis of blood. All controls sterile.

Case 4.—Patient, aged 25; impacted wisdom, anterior cusps showing; some swelling of mucous membrane; no pus observed, but practitioner referring case stated that pus had been present; pulp swollen and slightly moist, grey in colour. Direct smear showed a few polymorphs, no micro-organisms seen. Aerobic cultures gave *Str. longus* in glucose broth. Anaerobic cultures sterile. Subcultures on solid media revealed distinct colonic hæmolytic zones. All controls sterile.

Case 5.—Patient, aged 24; impacted wisdom tooth, completely buried; patient complained of loss of power of concentration, and stiffness in jaw;

pulp dry and slightly moist. Direct smear showed no micro-organisms. Aerobic cultures gave growth of streptococcus in glucose broth. Subculture on solid media failed to reveal hæmolysis of blood. All controls sterile.

Case 6.—Unerupted premolar removed from a child for crowding of the arch. Direct smear showed no micro-organisms. Cultures: all tubes sterile up to seventy-two hours at 37° C.

Case 7.—Patient, aged 20; impacted wisdom tooth, one cusp showing; history of rheumatic fever and albuminuria, also several attacks of Vincent's angina, and severe neuralgic pains. Pulp moist and slightly grey. Direct smear showed a few streptococci. After forty-eight hours at 37° C. anaerobic cultures gave a poor growth of streptococci, which produced very slight hæmolysis on subsequent subculture. Aerobic culture gave growth of streptococci, which showed definite hæmolysis on subsequent subculture. All controls sterile.

Case 8.—Patient, aged 59; upper wisdom tooth in close relation to septic root; pulp dry and of normal appearance. Direct smear showed no micro-organisms. Cultures remained sterile up to seventy-two hours at 37° C.

Case 9.—Patient, aged 19; impacted wisdom tooth, both anterior cusps showing; pus present, patient had trismus; pulp moist and swollen. Direct smear showed a few pus cells, no micro-organisms seen. Anaerobic cultures gave pure growth of *Staphylococcus albus*. Aerobic cultures gave growths of *Str. longus* and *Staph. albus*. On subsequent subculture and plating definite zones of hæmolysis were detected round streptococcal colonies. All controls sterile.

Case 10.—Lower wisdom tooth from the same patient as in Case 7; one anterior cusp showing. Cultures, all tubes remained sterile up to seventy-two hours at 37° C.

Case 11.—Patient, aged 23; lower wisdom; complained of trismus and pain in the ear, and patient's doctor had diagnosed an acute mastoid; pulp very moist, swollen and slightly grey. Direct smear, no micro-organisms seen. Cultures, pure culture of *Str. longus hæmolyticus*. All controls sterile.

Case 12.—Patient, aged 28; impacted wisdom, complained of pain in ear; pulp normal in appearance. Direct smear showed no micro-organisms. Cultures all sterile up to seventy-two hours at 37° C.

Case 13.—Patient, aged 22; pain in ear; pulp very moist and swollen. Direct smear, no micro-organisms seen. Cultures. No growth for forty-eight hours, then *Str. longus hæmolyticus* appeared. All controls sterile.

Case 14.—Patient, aged 29; lower wisdom, pain and trismus; pulp moist and swollen. Direct smear showed no micro-organisms. Culture gave growth of *Str. longus* after forty-eight hours at 37° C. All controls sterile.

Case 15.—Patient, aged 42; lower wisdom; patient suffering from neurosis; pulp normal in appearance. Direct smear, no micro-organisms

seen. Culture gave mixed growth of streptococci and a staphylococcus. All controls sterile.

Case 16.—Patient, aged 21; lower wisdom tooth, general streptococcal septicæmia twelve months ago; pulp slightly grey and moist, normal size. Direct smear showed no micro-organisms. Culture gave growth of *Str. longus hæmolyticus.*

Case 17.—Same patient as No. 16; wisdom tooth; pulp blood-stained and dry, slightly shrivelled. Direct smear showed no micro-organisms. Culture gave pure growth of *Str. longus hæmolyticus.*

Case 18.—Patient, aged 65; lower wisdom tooth involved in dentigerous cyst, patient complained of neuralgia; pulp blood-stained and slightly moist, rather small and tough, unsuitable for direct smear. Glucose broth culture only prepared, this gave growth of *Str. longus non-hæmolyticus.* Control cultures sterile.

Case 19.—Patient, aged 10; wisdom fully erupted, but tooth impacted; pulp moist and blood stained. Direct smear showed pus cells only. Cultures gave growth of short-chained *Str. non-hæmolyticus.* Control cultures sterile.

Case 20.—From same patient as Case No. 15. Pulp dry and normal. Direct smear, no organisms. Cultures remain sterile up to seventy-two hours at 37° C.

Case 21.—Patient, aged 35; partly erupted wisdom; complained of neuralgia and trismus; gum inflamed. Pulp dry and normal. Cultures remained sterile up to seventy-two hours at 37° C.

Case 22.—From same patient as No. 21; pain and neuralgia; inflamed gum; pulp extremely dry and shrivelled, not sufficient for direct smear. Culture gave growth of *Staph. albus.* All control cultures sterile.

Summary.

Number of teeth examined, twenty-two.

Eight teeth gave no growth, all of these had pulps of normal appearance.

Four teeth gave a growth of non-hæmolytic streptococci. In all these cases the pulp was abnormal in appearance.

Seven teeth gave a growth of hæmolytic streptococci; four were pure cultures. Of the other two, one was associated with *Staph. albus*, and the other with *Bacillus verosis.* In all these cases the pulp was slightly abnormal and grey in colour.

One tooth gave a pure culture of *Str. viridans*, the pulp in this case being moist and swollen.

One tooth gave a very mixed culture of streptococci and staphylococci, the infection being so mixed that it was not plated out.

One tooth gave a pure growth of *Staph. albus* in culture.

In all cases the control cultures remained sterile. It will be seen that the majority of the cases investigated gave definite proof of infection. If

this is the usual state of affairs it suggests that the method adopted by many of treating impactions, by removing a sound tooth and leaving the wisdom, is not only poor surgery, but does not do more than relieve the immediate symptoms. The patient is left with a septic focus which he would not have if the wisdom tooth had been removed.

As yet the investigation has not been carried far enough to say very much about the type of infection and the relationship it bears to the clinical features of the case, but the fact is established that these teeth may be a source of focal infection, and therefore deserve careful consideration.

In closing this paper I wish to record my thanks to Mr. A. H. Walters of the Royal Albert Dock Hospital, for carrying out the laboratory work, and also to Captain W. A. D. Drummond, for help given on the clinical side.

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Editorial.

REPORT OF THE MEDICAL RESEARCH COUNCIL FOR THE YEAR 1931-1932.

In the Introduction to the Report the Council again stress the importance of research in which the human subject is the immediate object of scientific study. They have given clinical research a primary place in their policy from the beginning of their work. The problem has been to find means of promoting the conditions in which clinical research work in this country may be brought to its fullest development.

It will be remembered that in 1916 the Council gave a practical demonstration of the possibilities of a research department organized in University College Hospital, London: Sir Thomas Lewis was appointed Director with charge of beds and as a result numerous important additions to our knowledge of the heart and vascular system were made. During the past year the Rockefeller Foundation of New York endowed in perpetuity the Directorship of the Research Department held by Sir Thomas Lewis and the Council are using the money thus liberated for the same sphere of work. They were approached by the National Hospital for Nervous Diseases, Queen Square, with the proposal for the establishment by this Hospital of a research department with adequate beds in a self-contained structural unit of the building to be placed under a whole-time Director provided by the Council. The research department is now in formation and Dr. A. E. Carmichael has been appointed by the Council as whole-time Director for a period of five years.

The Council believe that studies of the nervous system must play an indispensable part in medical advance and in the Report give a brief review of the present position as they see it. By studies of central localization and by tracing the complex distribution of nerve-cells and fibres nervous diseases were given descriptions which interpretated their symptoms in terms of anatomical structure. The Council consider that this wave of progress has come to an end; it could hardly be carried further by clinical studies. They think that neurology is waiting for a better knowledge of bacteriology, for light upon the nature and behaviour of the viruses which selectively attack parts of the system, for better biochemical knowledge in relation both to disordered function and to the part played by nutrition in the maintenance of the normal.

Apart from problems of nutrition and bacteriology, it had been assumed by the neurologist and the physiologist that all disorders of the nervous system are traceable to disorders of the universally essential process conduction, and so similarly would be the operations of drugs or other remedies. Long ago Sir Charles Sherrington showed that "central excitation" and "central inhibition" must be processes different in kind from "conduction."

The examination of these two processes has been the main object of the recent work at Oxford, to which the Council have given all the aid required. Experimental evidence now shows that central excitation of the nerve-cells and central inhibition can both show summation of effect: this established these two processes as quite distinct from "conduction." The true relations of the two processes are different and it seems clear that the intimate seat of the two processes is not the same.

At the National Institute for Medical Research work on virus diseases has been continued.

It is stated that further data obtained from the study of "bacteriophages" have strengthened the analogy between these infective agents and those generally recognized as typical viruses. Dr. Andrewes and Dr. Elford have subjected different bacteriophages to critical filtration. The diameter of the smallest bacteriophage yet examined was found to be identical with the virus of foot-and-mouth disease. The largest bacteriophage was stopped by a filter of such relative coarseness as to suggest that its particles are almost within the range of microscopical detection. The size of any one bacteriophage was found to be remarkably constant and uniform, independently of the nature of the bacterial organism which it attacks, and it is unchanged by purification.

Dr. Burnet, working in Australia with different species of the Salmonella groups of bacteria, has found that many of them regularly produce a filtrate rich in bacteriophage, but they are relatively resistant to the destructive agent so produced. Other species, and two in particular, never produce an active filtrate when grown in culture by themselves, but are so consistently attacked by the bacteriophages of the strains previously mentioned as to be sensitive indicators of their presence.

Dr. Burnet has also prepared a number of sera which specifically neutralize the action of different bacteriophages. But two bacteriophages each acting only on a different bacterial species may be identical in their reactions to immune sera; and on the other hand two bacteriophages which both react on the same bacterial strain may be clearly differentiated by their serological reactions.

These facts are regarded as difficult to reconcile with the conception of bacteriophages as chemical products of cells upon which they produce their effects; they seem to strengthen the analogy between the properties of the bacteriophages and those of the recognized viruses.

Dr. Todd has found the bacteriophage specific to the *Bacillus salmonicida*, the cause of "furunculosis" of salmon trout, present in water from the Thames, from the upper reaches of the Arun and the Ouse in Sussex, and from the Clwyd in North Wales. As the bacteriophage probably indicates the presence of infected fish, its discovery may be useful in tracing sources of infection both in rivers and in fish hatcheries.

Experiments by Clifton on the inactivation of bacteriophages by methylene blue in the presence of oxygen and with exposure to light seemed

to favour the idea of regarding the bacteriophages as chemical agents in solution. But Dr. Perdrau and Dr. Todd have shown that the only rays of the visible spectrum effective in this reaction are those which methylene blue absorbs. A similar inactivating action of methylene blue with oxygen has been found in the case of vaccinia, herpes, " louping ill," and fowl plague. This suggests an analogy between virus diseases and bacteriophages. The analogy is made closer by the fact that the presence of living bacteria protects the bacteriophages from inactivation, and that some of the viruses have been found to be similarly protected only when free and not if attached to, or incorporated in, living cells susceptible to their infective action. Dead cells afford no protection to bacteriophages or to viruses.

In the Council's earlier reports the investigations by Dr. Gye and Dr. Purdy, and others by Dr. Andrewes, on the malignant tumours of birds were mentioned. These tumours are remarkable for the fact that they can be transmitted by cell-free extracts; but until lately it was thought that the tumours could only be produced in birds of the same species from which they are derived. Fujinami, however, discovered a fowl sarcoma and showed that it was capable of growing also in ducks. Dr. Gye has produced this tumour in the duckling by injecting a cell-free filtrate, and by similar filtrates it has been transferred from duckling to duckling through twenty generations. A small dose of the filtrate or of the tumour cells injected into the adult duck produced only a temporary tumour: the growth disappeared spontaneously, after which the bird became completely immune to further injections. Dr. Purdy, however, has found that by injecting a large dose of living tumour cells a progressive tumour, capable of being propagated, developed. Later he found that the fowl sarcoma of Rous could be transmitted to young ducklings and propagated in them by using large injections of tumour cells.

Further, experiments have now shown that the Fujinami tumour, though it originated in the fowl, consists of duck cells when it has been transmitted through the duck, as if a virus had induced in the cells the properties of malignant growth. The Rous tumour cells, on the other hand, when transmitted through ducklings by repeated grafting, retain their original specific characters as fowl cells. Though the Rous tumour can be propagated in the fowl by a filtrable virus-like agent, it can be propagated in the duck only by a method analogous to that by which a mammalian tumour can be propagated within the limits of its own species.

It appears that in artificial cultures of an intestinal protozoon certain bacteria that profoundly influence its growth are always present. In the case of *Entamœba histolytica*, Mr. Dobell has found that certain bacteria are favourable to the growth of the protozoon, but others are not. The entamœba is unable to form cysts unless particular species of bacteria are present, and the cysts are also unable to hatch in a sterile medium or in the presence of dead bacteria only. Other events in the life history of the

protozoon are found similarly to depend on the presence of the appropriate bacterial concomitants. These results may throw light on the conditions which cause the *Entamœba histolytica* to become actively pathogenic under the conditions of life in the tropics.

Sir Leonard Hill and Dr. J. A. Campbell have been working on the rate of uptake of nitrogen by the brain, liver and bone marrow of animals exposed to high pressures such as are encountered in diving work at great depths. They have found that the nitrogen dissolved rises rapidly up to a period from about the third to the fifth hour of exposure, by which time the tissues are about half saturated with nitrogen at the particular pressure used. After that the increase towards saturation proceeds very slowly. These observations explain the practical experience that the danger of bubble formation during decompression after exposure to high pressures increases rapidly up to the period between the third and fifth hours, and thereafter shows no obvious increase.

Up to last year the therapeutically active principles of ergot of rye seemed to be settled. It was known that the drug contained ergotoxine, ergotamine and certain "amines" of much wider occurrence, and it had been shown experimentally that of these constituents only ergotoxine and ergotamine had an action on uterus. At the Obstetrical Unit, University College, Dr. Chassar Moir has now demonstrated that they have a similar action on the puerperal human uterus.

But extracts of ergot as ordinarily prepared, which appear to act well in obstetrical practice, apparently do not contain any significant amounts of the specific alkaloids or of the non-specific amines. It was difficult to explain their action until Dr. Moir by direct observation on the human uterus obtained convincing evidence that the watery extracts contain a principle different from any of those known hitherto and which is capable of producing activity of the uterine muscle when the preparation is taken by the mouth in the ordinary way. Dr. Dudley is now studying the chemistry of this unidentified substance in association with the clinical observations of Dr. Moir.

In last year's Report a full account of the isolation of the anti-rickets vitamin calciferol was given. In the conversion of the inert ergosterol into the biologically active calciferol it was known that no change in quantitative composition is involved, but only some internal re-arrangement of the molecular pattern. The conception of the general structure of the sterols has been based on the work of Windaus and Wieland in particular, but the suggested formula left certain chemical evidence incompletely explained. The first clear evidence of its inadequacy came from the observations of Mr. J. D. Bernal who by applying modern methods of X-ray crystallography demonstrated that the spatial relations of the structural units in the sterol molecule cannot be that shown by the Windaus-Wieland formula. Dr. Rosenheim and Dr. King have now formulated a new conception of the

general structure of the sterols which conforms to Bernal's dimensional data and satisfies chemical requirements.

Calciferol has been obtained in pure form only as a product of the artificial irradiation of ergosterol; there is no chemical evidence directly identifying it with the natural vitamin. Dr. Callow and Mr. Webster are now trying to isolate the natural vitamin by methods which were successful in isolating calciferol from the irradiated mixtures; they are using material in which the vitamin has been concentrated from cod-liver oil, prepared for the purpose by the Glaxo laboratories.

It has been known for a long time that very large doses of irradiated ergosterol cause symptoms of poisoning associated with excess of calcium in the blood and deposits of calcium in the walls of the heart and blood-vessels, and that this occurs even when no calcium salts are given with the food, the calcium being withdrawn from the bones. This was in such marked contrast to the deposit of calcium in the bones caused by small doses of irradiated ergosterol, that it was thought it might be due to some by-product of irradiation, or to stimulation of the parathyroid glands. The preparation of calciferol enabled these possibilities to be tested. Large doses of calciferol have been found to produce the same effects as the mixed irradiation product. It has also been found that absence of the parathyroid glands makes no difference to the effects of large doses of the pure substance in mobilizing the calcium ions of the body.

In the Department for Clinical Research, University College Hospital, studies on pain in an active limb muscle deprived of its blood supply have been continued and have led to the conclusion that this pain is due to a purely chemical or physico-chemical stimulus developed in the muscle. The old theory that anginal pain is due to local bloodliness of the heart muscle has been reconsidered in the light of these researches, and little doubt now remains of its essential truth.

If the vessels of a human limb remain long obstructed paralysis of the limb nerves ensues. Sir Thomas Lewis and his co-workers have shown that loss of sensation begins at the extremities of the limb, in the case of the arm in the finger-tips, and spreads gradually up the limb and ultimately involves the whole of it. The motor apparatus is affected simultaneously and generally in a similar ascending order: the extensor muscles being affected before the flexor muscles. This centripetal paralysis has been investigated and it has been shown that the nerves in passing to the central nervous system become more and more susceptible to the lack of oxygen. This characteristic onset of ischæmic paralysis is said to give warning that if nerve and muscle have been equally exposed to a toxic influence and the muscle responds to direct stimulation, but not to indirect stimulation through its nerve, it cannot be concluded that the neuro-muscular function is necessarily at fault; the fault may lie in the nerve itself.

The order in which sensation is lost in a limb and in which motor

function weakens is strikingly similar in neuritis from toxic causes to that found in simple ischæmia and it is believed that a similar explanation applies to both.

Dr. Pickering has studied the mechanism by which changes in the external temperature control heat loss from the skin through the vessels. Of two separate mechanisms identified, reflexes from the skin have been found to be of less importance than has usually been supposed. Stimulation of the skin by cold produces reflexly an evanescent constriction of the superficial vessels, while stimulation by heat does not produce vasodilation reflexly. The most potent mechanism lies centrally in the body; it is stimulated by the change in body temperature which occurs when the temperature of the environment is changed. This mechanism tends to keep the body temperature constant and is stated to respond to changes of less than a tenth of a degree by appropriate alterations of the skin blood-vessels.

At Sheffield Professor Mellanby has continued his studies of the effects of diet on the nervous system. Last year it was reported that vitamin A deficiency in combination with a high cereal intake produced demyelination of the spinal cord similar to that known to occur in convulsive ergotism and pellagra. Although these results seemed to explain "lathyrism"—a nervous disease found in India when lathyrus peas are eaten—it has now been found that this disease only occurs when the diet is deficient in vitamin A and contains the lathyrus pea known as "akta"; with the variety of lathyrus pea known as "kesari" no spinal cord changes have been observed.

It has also been shown that diets which produce demyelination of the spinal cord also cause demyelination of medullated fibres in peripheral nerves and the degenerative changes are more marked in the sensory than in the motor nerve fibres. These results are thought to open a new chapter in the pathology of the nervous system; they may prove ultimately to have a bearing on the common nervous diseases in this country. Professor Mellanby has accordingly begun a study on the effects of diets rich in vitamin A on the treatment of disseminated sclerosis and subacute combined degeneration of the cord.

Other vitamin studies have been carried out by Dr. Harris who finds that the adrenal gland is rich in vitamin C, and that in vitamin C deficiency the gland undergoes characteristic degenerative changes.

Dr. Moore has observed abundant vitamin A reserves in many infective conditions, indicating that this vitamin cannot be considered as an anti-infective agent indiscriminate in its action. This work accords with Dr. Stanley Griffith's observation that resistance to tuberculosis is not diminished by vitamin A deficiency.

We regret that we have not sufficient space to deal with this valuable Report in greater detail. A brief study of the Report shows the wide scope of the researches now being carried out with the financial aid of the Council, in spite of the curtailment of their financial resources.

Clinical and other Notes.

AN ACUTE CASE OF LEUKÆMIA.

By Major W. BLIGH, O.B.E.,
Royal Army Medical Corps.

After struggling with the crossword puzzles of medicine for nearly half a century, my conception of leukæmia was of a disease that usually lasts for weeks, more often for months, and sometimes even for years. One's complacency was accordingly rudely shattered on coming face to face with a case, such as is recorded below, that passed through all the phases between health and death within the short space of fifteen days.

A young soldier, aged 18, was by the testimony of his mother and by his own feelings, in good health and of good colour until on September 29, 1932, when he felt unwell and reported sick, complaining of malaise, slight headache and some soreness of the throat. He was found to have a rise of temperature to about 100° F., and as a precautionary measure was sent to hospital. It was then noted that he had a septic sore at the right angle of his mouth and an enlarged submental gland apparently secondary to this.

From this innocent commencement the picture of his disease rapidly unfolded itself.

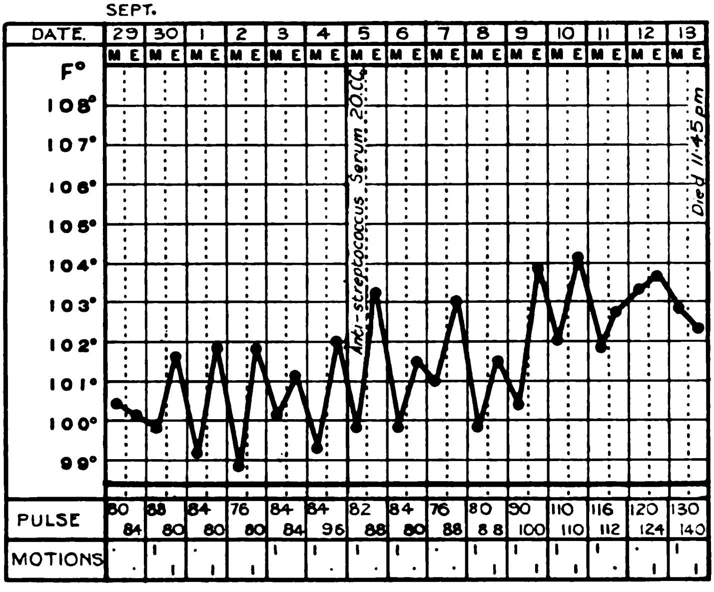
Anæmia, slight at first, quickly became intense both in his skin and the mucous membranes of his lips, mouth, and palate. Pyrexia steadily mounted so that three days before his death it had reached and passed the 104° F. mark. A moderate enlargement of chains of cervical glands crept downwards from the lower jaw to both clavicles. The spleen rapidly increased in size until at death it had reached the level of his umbilicus.

The liver also became enlarged until its edge was palpable three fingers breadth below the costal margin.

The sore at the right angle of his mouth developed into a small deep ulcer, and in the discharge from this streptococci were found. On one or two occasions during the second week of his disease, slight oozing of blood occurred from the gums, to be followed once by a moderate hæmorrhage. Five or six large petechiæ appeared on the soft palate, and a slight dusky bruise over the tibia and extensor muscles of the left leg. He sweated profusely after the first day or two and his hearing became notably dull during the second week.

On the ninth day of his illness the differential white count was: polymorphs, 1 per cent; large lymphocytes, 74 per cent; small lymphocytes, 19 per cent; basophils, 6 per cent; eosinophils and others nil.

The red blood-corpuscles were unaffected in shape and character, and the clotting time of the blood was shorter than usual. On the thirteenth day of his illness the differential white count was unchanged: Total white cells, 9,000 per cubic millimetre; total red cells, 1,200,000 per cubic millimetre; hæmoglobin, 50 per cent; colour-index, 2·1.



No streptococcus was found in blood-smears or culture. *Staphylococcus albus* was present in the blood on culture, but this was thought to be accidental.

The urine was normal throughout.

For the first eight days he made no complaint of any pain or discomfort or feeling of illness. He then stated that his legs felt a little stiff, but percussion over the tibiæ revealed no tenderness, nor was any pain or tenderness associated with the enlarging spleen and liver. During the last two days, however, his pulse which had been quiet and good, became rapid and feeble, his sight grew dim, his respirations became laboured and he sank and died without any further signs or symptoms fifteen days after first coming under observation.

Diagnosis.—This was arrived at by a process of trial and error. A provisional concept of a staphylococcal infection of the angle of the mouth with a secondary infection of the submental gland was pushed on one side when the discovery of a streptococcus in the lesion, associated with pallor, profuse sweating, a rising temperature and some splenic enlargement suggested a streptococcal septicæmia. A few days later, however, the marked anæmia, the bleeding, the rapidly increasing spleen and liver pointed unmistakably to the true diagnosis, and this was clinched by the differential white count.

Treatment was at first by full doses of quinine and tinct. ferri perchlor, injection of antistreptococcic serum, and copious ingestion of glucose and water; later stovarsol gr. 4 was given twice daily and was entirely without effect.

I am indebted to Major E. B. Marsh, M.C., for kindly coming from Netley to see the case in consultation, and to him is due the second of the above examinations of the blood.

REPORT OF A FATAL CASE OF POISONING BY TETRACHLORETHANE.

By Major J. M. ELLIOTT,
Royal Army Medical Corps.

Fatalities as the result of drinking tetrachlorethane are so uncommon that a short description of the clinical signs of a recent case in Egypt and its attendant circumstances is considered to be merited.

Tetrachlorethane (also known as tetrachloracetylene) is a clear fluid with an odour rather like chloroform (this odour being characteristic of the chloro derivatives of paraffins), and is sold on the market under various trade-names as a grease remover.

It is to be found in Army offices in eight-ounce tins labelled "Silk Cleansing Fluid," being supplied by the Stationery Office for the purpose of cleaning the silk of duplicators. Records of poisoning by this substance show that the fatal dose may be as low as 5 cubic centimetres.

On November 17, 1932, at 8.45 a.m., I was summoned to the Medical Inspection Room, Zafaran, where I found Serjeant Y, a man 43 years of age, with eighteen years service, lying on a stretcher. He was completely unconscious and markedly cyanosed; pulse 90; respirations 20; pupils contracted and not reacting to light; corneal and conjunctival reflexes completely abolished; no external signs of injury; his breath smelt strongly of a chemical having the odour of chloroform. I gave instructions to search his bunk for any bottles of which the contents might have been drunk, and I took the patient forthwith to the Officers' Hospital in the waiting ambulance, and washed out his stomach. By this time a tin of fluid labelled "Silk Cleansing Fluid," and subsequently proved by analysis to be tetrachlorethane, was handed to me, having been found in the patient's bunk.

At 9.30 a.m. respiration began to fail and the patient ceased breathing altogether, but the heart was still beating strongly; artificial respiration was carried out for several minutes, oxygen administered, and a hypodermic injection of camphor in oil given, and respiration was re-established.

At 9.45 a.m. it was noted that the patient had passed urine and fæces involuntarily, the voided material smelling strongly of the silk cleansing fluid, but whether the smell was from the urine only, as seemed likely, or from both excretions, could not be determined.

Administration of oxygen was carried out almost continuously as the patient's face and extremities were extremely cyanosed; a further injection of camphor was given at 12.45 p.m. At 1.30 p.m., a saline enema of five ounces was retained, and during the afternoon the patient appeared to be holding his own; there was a very faint pupillary response to light from 2 till 3 p.m.; an enema of coffee and saline was retained at 4 p.m. At 5.45 p.m. the pulse rose from 116 to 128 and began to fail considerably; an injection of $\frac{1}{30}$ grain of strychnine hydrochloride was given, and at 6.15 p.m. a further injection of camphor, but the pulse became rapidly weaker and almost imperceptible, and at 7 p.m. the patient suddenly expired, approximately twelve hours after drinking the poison.

The following notes are extracts from a post-mortem report made by the Medical Specialist, Major W. E. K. Coles, R.A.M.C.:—

". . . No staining of the lips or mouth . . . the stomach contained free fluid smelling strongly of the chemical referred to . . . the whole of the gastric mucosa was very hyperæmic, but there were no perforations . . . kidneys normal in size, slightly congested. . . . Heart, liver and spleen appeared normal. . . . The alveoli of the lungs showed signs of acute congestion."

A suggestion was forwarded to General Headquarters by the Assistant Provost Marshal that this silk cleansing fluid should be kept under lock and key, and should be labelled poison, and an order to that effect has been issued.

I am indebted to Colonel J. Tyrer Johnson, D.S.O., Deputy Director of Medical Services, The British Troops in Egypt, and Major L. Murphy, D.S.O., R.A.M.C., Senior Medical Officer, Abbassia and Helmieh, for permission to forward these notes for publication.

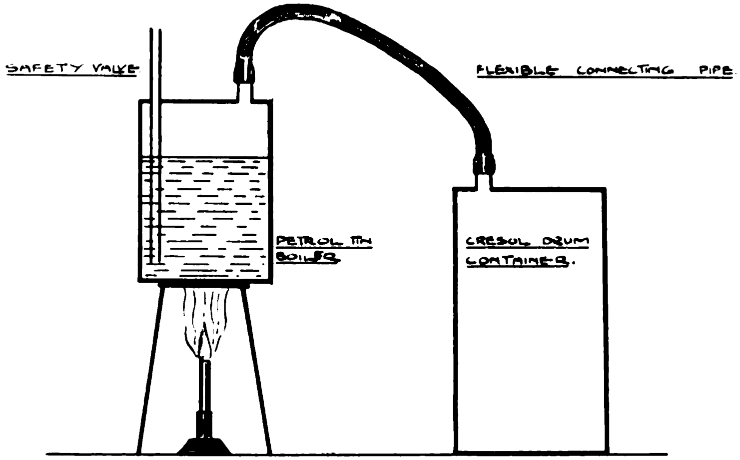
A PRACTICAL TEST OF THE LETHAL ACTION OF STEAM AND FORMALIN VAPOUR ON SPORE-BEARING ORGANISMS AND BUGS.

BY PRIVATE A. F. ALDERSON,
Royal Army Medical Corps.

THE apparatus required for the experiments was improvised from a length of rubber tubing, a two-gallon petrol can and a cresol drum with a capacity of 1,350 cubic inches. The petrol can was fitted up as a boiler, a Bunsen burner supplying the necessary heat. The cresol drum with the bottom cut out made an admirable substitute for a Lelean sack. A length of rubber tubing (ordinary garden hosepipe) connected the two tins, the hose connections being in each case at the top (see sketch).

The organism chosen was one of the subtilis group and was isolated from horse manure. A luxuriant growth was obtained on agar plates. A

cotton-wool swab was contaminated with the growth and an agar slope was inoculated as a control. The swab was placed in the cresol drum and steam passed in at the top; the swab was in contact with the steam for ten minutes. After removal another agar slope was inoculated from the swab. This slope was incubated for twenty-four hours and a profuse growth was obtained.



SEMI-DIAGRAMMATIC SKETCH OF DISINFECTOR.

This process was repeated with lengthening periods of contact with the steam, with the following results:—

Period	Result
10 minutes	+
10 ,,	+
10 ,,	+
15 ,,	+
15 ,,	+
15 ,,	+
30 ,,	+
30 ,,	—
30 ,,	+
45 ,,	+
45 ,,	+
45 ,,	+
60 ,,	+
60 ,,	—
60 ,,	+

+ = Growth obtained after contact.
— = No growth.

It follows, therefore, that even one hour's exposure to steam is no guarantee of sterility from sporing organisms.

Five hundred cubic centimetres of formalin were added to one gallon of

water and put into the boiler. A powerful pungent vapour was given off necessitating the use of gas masks.

Swabs were again inoculated with the organism, and controls were again put up and showed a profuse growth.

The swabs were placed in contact with the formalin-impregnated steam for the following periods :—

Period	Result
30 minutes	–
30 ,,	–
30 ,,	–
20 ,,	–
20 ,,	–
20 ,,	–
15 ,,	–
15 ,,	–
15 ,,	–
10 ,,	–
10 ,,	–
10 ,,	–
5 ,,	–
5 ,,	–
5 ,,	–
3 ,,	–
3 ,,	+
3 ,,	–
3 ,,	+
3 ,,	+
3 ,,	–

This shows beyond doubt that five minutes' exposure to the steam and formalin vapour is the minimum period of exposure for the destruction of spore-bearing organisms.

To demonstrate the lethal powers of formalin-impregnated steam on vermin, the following experiment was carried out.

A number of well-fed bed bugs was used. They were placed in the top and bottom corners of a room of 2,934 cubic feet of air space. The bugs were in small test tubes, the tops of which were covered with gauze, to allow free access of the vapour. A petrol can boiler was again used. Into this one gallon of water and 500 cubic centimetres of formalin were placed. This was brought to the boil in the room. The room was then sealed and left for one hour, during which time the water had been boiling continuously. The room was then opened and the vapour allowed to disperse. All the bugs were found to be dead.

Travel.

BEYOND LEH.

A SHOOTING TRIP IN LADAKH, 1926.

Being a Diary kept by

K. W. DICKSON, F.R.G.S.

"When you are old and grey
And full of sleep
And nodding by the fire
Take down this book. . . ."

I.—LAHORE TO SRINAGAR.

WE had been four years in India and had been married for nearly nine years and never had a whole month's holiday. In 1923 we had ten days leave from Simla, and went five marches up the Hindustan-Tibet road as far as Bagi. That only whetted our appetites for the long leave which was always ahead of us but never seemed to materialize. In 1925 when we were in Simla it had been promised by the General, and R. started buying rifles, maps, and a telescope, and he talked of little else. We were not too happy, however, when the official application for leave had been sent up, for week after week passed and no answer came. We had burned our boats in the way of selling off kit and giving up our house in Lahore, as well as boarding out the ponies.

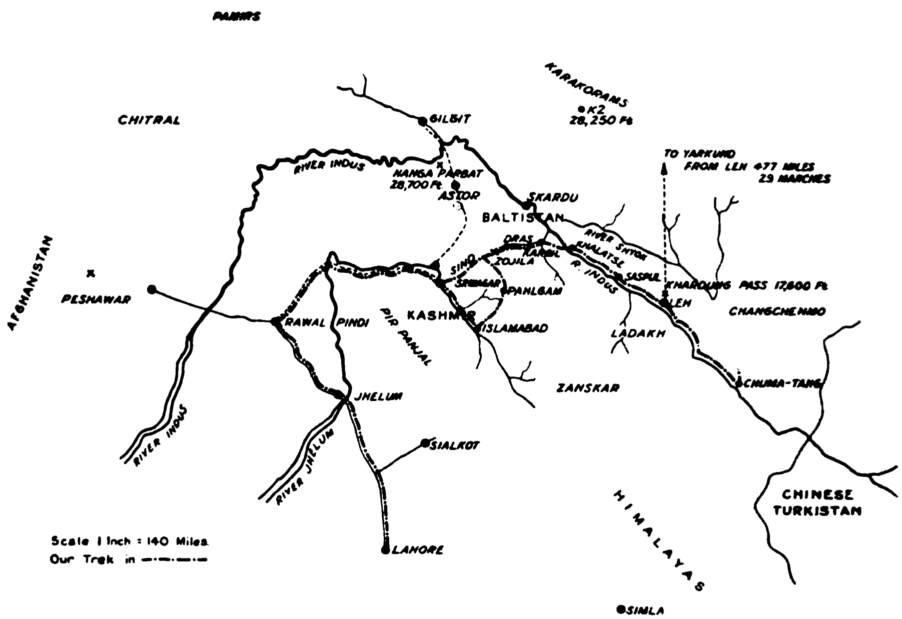
It was well on in March before we decided we could wait no longer, and R. telephoned to Simla to hear that 4½ months leave had been granted from April 7. I was very loth to give up our little bungalow where we had made a very attractive garden. I felt our house-keeping days in India were over for this tour at least, and we could never have our friends about us in such an intimate easy way for some time to come. Then there was the parting with a very good faithful lot of servants. On returning from leave we had only a few months to put in before sailing for home, and so hotel life seemed inevitable.

When leave was actually sanctioned and we were making real plans as we bent over maps, I was too busy to have any time for regrets about house, servants, or even a garden at its best.

It is a rule of the Game Preservation Department in Kashmir that for first leave (April to July) a block or nullah can only be booked by the applicant in person in Kashmir territory. As booking commences on January 1, it is a policy of "first come first served," and the man on the

spot can choose the best block for the particular heads he wants. Shooting in Astor, Baltistan, Ladakh, and other parts of Kashmir, all comes under the same department, and a big game licence costs Rs.125—about £9. The whole country is divided into a limited number of blocks which can be reserved, but the best heads of different animals have a fairly definite geographical distribution. The distribution is roughly as follows: Astor district for markhor, Baltistan for ibex, and Ladakh for burrhel, sharpu, and Ovis ammon.

R. had always had a great ambition to get a good markhor head, and it was therefore the Astor maps we studied most. I had seen markhor heads



in the museum in Lahore, and I could understand his keenness when I admired the long graceful corkscrew horns.

We left Lahore on April 6 in our new Overland car, heavily laden with baggage, gun, and rifles, our little old Gurkha bearer, and our two Airedale dogs, Garry and Kelpie. The first day was an easy run to Jhelum Dak Bungalow, where we spent the night, although we were unfortunate in having some punctures. We had eggs with our early tea next morning, and were on the road by seven o'clock. We could see the line of hills on the horizon as we covered the miles on the Grand Trunk Road.

The country people of that part of the Punjab seem to be the finest of any I have ever seen. They smiled as we passed, and the children called out on seeing our two big dogs in the back of the car, Kelpie sitting quietly, like the well-behaved dog he is, and Garry, not having reached years of discretion so far as a car is concerned, having to be held by the collar to

prevent him leaping out to give chase to a goat or send a pariah dog flying from our path.

We had lunch in the shade of a sheeshun wood by the roadside—rather a light one, as we found the cold chicken we had brought from Lahore was nearing decomposition. The petrol tank was filled at the Overland Agency in Rawalpindi, and then we started for Murree. The road was new to me, and R. had only gone by tonga fourteen years ago, when there were no cars on hill roads in India. The ascent is very steep at times, the road twisting and turning amongst the mountains until it rises to 7,000 feet above sea-level at Murree. We had to stop several times to fill up with water as the day was very hot. Many empty lorries came swerving and bumping round corners, and we had several narrow escapes. I suppose familiarity breeds contempt even on such a road.

Garry has a passion for chasing any animal. When we were having tea outside the Dak Bungalow at Tret, halfway up the hill, we had much ado to keep him from seizing a pet monkey which was doing tricks on a tent rope nearby. Garry hunts monkeys on every possible occasion in Kasauli, but there are no wild monkeys in the Murree hills or in Kashmir.

We had paid toll further down the road which should have been refunded at another toll gate, as we were going on to Kashmir, but no notice is displayed to this effect. The collectors are so slow in giving receipts, I can imagine that the majority of motorists pay their toll and hurry on—the money going to the upkeep of the collectors' families, instead of to the road.

We missed the turning at the entrance to Murree, and went up the hill instead of round it. We were able to turn where two roads meet, but we were annoyed at the loss of time, as we were not inclined to put up for the night at a Murree hotel—a roadside bungalow seemed so much more like leave, although it meant another twenty-six miles, and a descent of several thousand feet.

We had gone seven or eight miles down the road when we felt very hungry, so I suggested tea and a tin of sardines—most enjoyable—but boiling the kettle took much longer than we expected, and dusk had descended before we had been on the road for half an hour. We knew nothing of the rules of the road, or that the ox waggons, which almost line the road during the day, yoke up and start off at sunset. If the road had been clear we could have gone down comfortably at eighteen miles an hour, but these carts have no lights, and go on either side of the road, so our progress was rather slow.

We were now out of the pinewoods, but darkness was upon us, and we crept along, hearing the Jhelum roaring in the gorge on our right. R. suddenly said he could see no road ahead, and stopped the car to investigate. We walked ahead with an electric torch, to find there had been a landslide, and the outer half of the road had been carried away for a distance of thirty yards. There appeared to be just enough room for the car to pass with

about four inches to spare on the outside. It was now pitch dark. I agreed to take the dogs across and wait, if R. promised he would not sit in the car, but lean across and guide it from the inside step, ready to jump off if the car toppled over the precipice. I breathed again, and the dogs stopped barking and straining at their leads, when the car was safely on the other side of the gap. We went very slowly in case of another landslide, and missed the entrance to the Dak Bungalow at Kohalla.

Kohalla is a little village on a cliff overlooking the ravine of the Jhelum river—it is the end of British territory, and the bridge across the river just beyond is the entrance to Kashmir State.

There was room to turn the car before the bridge, but we had to reverse up the steep stony entrance to the Dak Bungalow. With the aid of a candle lantern and a smoky paraffin lamp we got up that hill. There was no fence on the outer side, and a wrong turn would have meant a drop of forty or fifty feet to the road below.

As we sat down to a late meal about 9.30 we felt we had had plenty of adventures for one day. We slept well and were off next morning at daybreak, and had breakfast at Domel, a charming little bungalow by the river. Rain came down in torrents before we reached Baramulla, and we decided to spend the night there instead of arriving in Srinagar in darkness.

The Kaj Nag mountains were smothered in mist when we started off next morning. Baramulla looked like a Dutch village with the river, once more navigable, and its green fields and rows of poplars. It was a straight easy run into Srinagar, a good wide road with no more twists and sudden turns, and it was a relief to get into open country again.

We slowed down going through the bazaar, and the car was at once weighed down by several men standing on the step at each side, anxious to earn some bucksheesh by showing us the way to our destination, the Army Agency. We tried to push them off, but two, more persistent than the others, were still clinging to the doors when we reached the Bund, where the Army Agency has its office.

II.—At Srinagar.

We arrived in Srinagar on a Saturday morning, and on Major Broome's advice, went straight to the office of the Game Preservation Department. We were lucky to find Major Radcliff, who is in charge—himself a famous big game hunter, and who was unfortunate enough to lose an arm when lion hunting in Africa.

To our immense disappointment we found that all markhor blocks worth reserving had been booked four days before our arrival. The young officers of the Punjab and Waziristan had wisely taken advantage of the Easter week-end to get a flying start, and had booked all the best nullahs. At first we felt only crushed, the disappointment was so unexpected. There was one markhor nullah left in Astor, but from its geographical position

Major Radcliff agreed that it was a most unlikely place to find a good head. We gave up that idea, and R. asked what else they had to offer. There were two sharpu blocks in Ladakh, where burrhel also might be found, and possibly Ovis ammon. R. turned to me saying, " Sharpu, those animals that feed on grassy slopes ; I thought when I was sixty I might take a sharpu block ! " Later we were to find that these sharpu were to give him more work and harder rock climbing than ibex had ever done.

So that is how it came about that we went to Ladakh. My disappointment about the markhor nullah was tempered with a longing to see the country of the Lamas. We had read no books about Ladakh, and had hardly glanced at the maps of the country—all our attention had been focused on Baltistan and the Gilgit road. The kit I had brought with me was intended for either of these places, and Ladakh is much higher above sea-level, and very much colder in spring. I had not even a tweed coat, only a drill riding coat. We had four blankets each, a rezais each (i.e., a wadded quilt used as a mattress when travelling in India), and we bought two numdahs or felts to put beneath the rezais in cold weather. We took no sheets, and our pillow slips were made of holland. These last were soft, being linen, and they at least never looked so soiled as white ones would have done. I was only allowed to take one jersey frock besides my marching kit, as R. said I would have no occasion to wear anything else—which only goes to show how little men know about women's clothes !

We spent the next four days in repacking yakdans (leather-covered boxes specially made for mule or yak transport), and in buying stores which we packed in the same way. Fresh vegetables and potatoes were put into skin-covered baskets, as these could be discarded later as the stores were used up. The tents were pitched in the compound of the Army Agency for our inspection, and I felt quite elated at sight of them, as I had only slept in a tent for a month once in an orchard in Somerset. We had two eighty-pound double fly tents for our own use, one for sleeping and the other a dining-room in which the yakdans were kept. The Kashmiri servants had a single fly tent the same size as our own, and there was a small one for a kitchen, where the cook and bearer slept. Two camp beds, a folding canvas-topped table, and two very hard and uncomfortable folding wooden chairs completed our equipment. Why we did not take two Roorkee chairs instead of the wooden-seated ones, I cannot imagine. We certainly regetted our choice every day when we arrived in camp.

Owing to a sequence of Mohammedan and Hindu holidays, the banks in Srinagar were closed for several days, and it was only by the kindness of a friend who knew the agents that we were able to get the money we required to take with us, including a large supply of small change in six leather money bags. Those four days in Srinagar seemed endless until we really got on the road. I was haunted by a half fear that I would prove unfit for such a long trek and be a hindrance. I soon forgot any such ideas when the start was made, but I found the days of preparation very trying.

Srinagar was cold and wet in April—as cold as Edinburgh in March—and Kashmir was not rising to my expectations at all.

The usual way to start up the Sind valley is to take a boat with all the baggage by river to Gunderbal, but R. thought we should start on foot from Srinagar, so as to get our legs and feet somewhat harder before we reached the stiffer marches further on. The Agency had engaged a good shikari, who in turn had got two tiffin coolies from his village, and a sweeper who would look after the dogs. We protested that two tiffin coolies were unnecessary, but he insisted that one was not enough when a memsahib was there—or lady sahib, as he always called me. Later on we found that one would have been ample when a large saddle bag is used on the riding pony. This not only makes the wooden saddle of Ladakh much more comfortable, but carries all the extra kit, and the pony man is always proud to carry a camera or a pair of field glasses.

III.—First Marches from Srinagar.

On Thursday, April 15, we set out from Srinagar. We had ten pack ponies which had been laden early that morning and left half an hour before we did. We carried with us bread and some cooked food in the tiffin basket, to give our cook as little work as possible until he got accustomed to marching. He is a Punjabi Mussulman who has been with us for four years, and so was not used to trekking as were the Kashmiris.

The idea of starting on foot from Srinagar with a view to getting muscles harder straight away is sound in principle, but I would not recommend it. Those first few miles through Srinagar and the villages surrounding it were sheer misery. The streets were narrow, uneven and unspeakably dirty, but the pariah dogs disturbed us most. Kelpie and Garry are not aggressive, but when these village dogs came out in numbers they went for the first dog they saw, and had to be rescued with the help of our khud sticks. The noise of the yelping of the pariahs as they disappeared into the rabbit warren of side alleys drew out another batch further along the street, and so it went on for two hours. Our heads ached with all the noise, and the sun beat down on these narrow streets. We were glad to leave villages behind, and sit down under a big walnut tree between some fields to make our coffee for lunch.

I had used the riding pony very little, as it had an uncomfortable way of walking slowly for ten steps and jogging for five. This was repeated in a sort of rhythm, and it was not a soothing one.

There is one pretty little bit where the road lies near the Anchar lake—it brought back to my mind the banks of the Holy Loch in Argyllshire.

Our legs were weary and our feet sore and blistered by the time we reached the Dak Bungalow at Gunderbal. The bungalow is very little used, and is small and dirty. It would have been preferable to pitch camp,

but that would have taken time, as the servants were tired, and the ponies were already unloaded, and the rooms prepared for us.

We marched in chapplies, and although they are undoubtedly the most comfortable footwear for the road, it was natural that our feet were blistered in spite of thick socks, as this was our first march. For the first time I had my feet and legs massaged by the shikari and tiffin coolie, which eased the stiffness and relieved the pain. After that it was a regular custom, fifteen minutes a day on our arrival in camp. Waking up next morning, we laughed as we remarked on our thin faces—a result of the blistered feet I feel sure.

Although people go to Gunderbal to escape the heat of Srinagar in July and August, we found it more sheltered and not so cold in April. At that time the snow had not begun to melt on the higher hills, so the Sind river was small, and made little difference to the temperature.

That evening at dinner a tall youth appeared and helped our bearer. We remarked that he must be the dak coolie, but about a week later our cook told us he was the shikari's son, who had been brought to learn his trade at our expense.

We slept fitfully, and probably a good sprinkling of Keating's powder would have been worth while! When half awake, that delightful semi-conscious feeling came over me that something nice was happening to-day. In a second I was wide awake—yes, we were really on the road. Long before I was dressed I heard the yakdans being carried from the verandah to the waiting ponies. By half-past eight we were following a level winding road through pretty villages with chalet-like houses. The people live on the ground-floor and use the top for storing the winter's supply of grass.

Our path lay between fields of sweet-smelling mustard—the soft yellow colour showed up against the dark snow-capped hills and the deep blue sky above. Garry in his joy started chasing sheep, but came back when he was called.

After crossing the Wazil bridge, we came at once to a moorland road. No motor or tonga is allowed to cross this bridge, and indeed the road beyond is unsuitable for wheeled traffic, even if the bridge were strong enough. There were large cobble stones everywhere, as if we were walking in an old river bed.

I never saw so much mistletoe as on the chinar trees in the Sind valley.

The Sind river is a fast-flowing stream, and both it and its surroundings made us think of the Spey. It was a deep clear sea-green colour, not at all like the tumbling, tossing, muddy river that we rejoined three months later at Baltal.

The sun was very warm, and I was glad I was wearing shorts under my riding coat, instead of the tweed knickerbockers which were for colder days. We went some distance beyond a tiny village before stopping for lunch, as Kashmir villages are not too clean. The tiffin coolie made a fire, and I warmed some stew which had a tempting smell for two hungry

people and two hungry dogs. We finished our lunch with some walnuts, of which I had brought a few hundreds. We found them a very useful addition to our stores in a country where there was no fresh fruit or vegetables.

I was riding a bit ahead when we came to the Wangat nullah, and there was a good deal of water crossing the path, so I sent the pony back for R. A sahib with a little fox terrier had passed us while we were having lunch, but we found him in the bungalow when we arrived at Kangan. The bungalow is a new one, and is clean and roomy. After tea we sat on the verandah and talked to the sahib. He was on his way to the Zanskar range. He had been to Wardwan the previous year, and it was very interesting to hear his experiences there, and the country was all so new to me.

The shikari came for orders for the next day, and suggested that we should go beyond Gund, the usual stopping place, to a village called Kulan, and pitch our camp there, as there is no bungalow. The snow was lying half a mile beyond Kulan, and if we camped there we could make an early start and get beyond the most precipitous places on the road before the sun had begun to melt the snow. At these places there was real danger of avalanches and rocks falling from above.

With a long march before us next day, we had dinner early and went straight to bed. We were wakened at six and started off as soon as we had finished breakfast. The road was again very rough, with large cobble stones to be avoided at every step. I was very weary and went to sleep for a few minutes, lying on the ground after lunch at the roadside, but we did not have much time to spare, and the baggage and servants had passed us. As we reached Gund, we were surprised to see the shikari and baggage at the bungalow. The sky was overcast, and he decided that unless the weather was settled, it was useless going on to Kulan. If the tents got wet, they would have to be dried before we could go any further, as beyond Gund all baggage had to be carried by coolies.

The Dak Bungalow was the worst we had seen, and I suspected that the rooms had been used by coolies when no sahibs were there. The mud walls in one room were not even whitewashed. I was tired, and found the leg massage very soothing. We had to drink our tea without milk, as there was none to be had. In these high lands where the snow lies well on into spring there are no kids or calves until May and June.

That afternoon we had to make a complete rearrangement of baggage for coolie transport. The heavier tins of food were removed from yakdans and put into sacks or kiltas. Each coolie was allotted his own load, and there was great noise and competition for the lighter loads. Sixty pounds is the maximum weight, and the shikari tried the weight of each load before they were stowed away for the night. There were no stores of any kind to be had at Gund, but we had brought a plentiful supply of eggs from Kangan at sixpence a dozen, and three small fowls.

Sitting by the river we watched a storm coming up on both sides, and it was not promising for an early start next morning. Conversation was impossible, as the water came tumbling down with a steady deafening roar. The pine-clad hills on the opposite bank rose straight up in front of us, so the valley was in shadow, and the air grew chilly quite early in the afternoon.

As we came up from Kangan there was less and less blossom on the fruit trees. The willows were just beginning to drop their furry catkins, and were showing a little green. No other trees were in leaf. The road is like many a hill road in Scotland, bordered by the finest turf, close-cropped by sheep. I haven't played golf for a very long time, but I could not help thinking what grand lies there were for a brassie. I thought bracken grew in this kind of country, but there was none.

There was benefit, I found, from sleeping in blankets—when a parasite makes an attack at night, it can be chased with a lighted match with no danger of fire, then the charred body is removed and again there is peace.

On our first Sunday morning, tea was brought at 5 o'clock. We had hoped to make an early start, but rain was coming steadily down, sometimes sleet, so we returned to bed.

There was fresh snow on the hills all round us, and the road to Sonamarg was impossible in rain, with the danger of avalanches. We heard the rain pouring down all the next night, so there was no chance of moving. The temperature had dropped, and we were glad of our Gilgit boots and big coats. The pines quite near us looked like Christmas trees.

I busied myself in giving out stores and in getting the first mail ready. Coolies coming from a village further on told us that four men were held up in the Dak Bungalow at Baltal.

The sahib who was bound for the Zanskâr range lent us a weekly edition of the *Times*; it was at least a month old, but was new to us.

After a good night's sleep we at last wakened to a clear starry sky, and we were on the road shortly after six. I might have said "in" the road, as it was six to eight inches deep in mud. I was very glad to ride a little cream-coloured pony for the first three miles and keep my feet dry. R. had a very bad time in the deep sticky mud, his grass shoes being nearly sucked off at every step, but fortunately the surface of the road improved after the first few miles.

IV. –Into the Snow.

It was a pretty winding road, the valley narrowing to a gorge in places. We came to one great avalanche, with snow fifteen feet high on the path. The pony was led round it, and I was able to ride another mile. It was lucky I did this, as I was to need all my energy later that day.

There was deep snow after the seventh milestone from Gund, and the pony could go no further and had to be sent back, after paying the pony boy. Just then part of a snow bridge fell into the river, and with a long roar, a

great mass of snow on the far bank, having lost its support, fell into the tumbling water and was washed away. Luckily our bank of the river was not so steep at that place, but in a few minutes we were crossing a much bigger mass of avalanche snow, sloping sheer down to the river 100 feet below. R. went first, I followed, and the coolies brought up the rear. They would not let me stop for a minute to get my breath, and I could see they did not like the dogs jumping along on the slope above us. Burra Subana kept repeating in Hindustani: "Very bad place this, very bad place."

Shortly afterwards snow began to fall, and we still had five miles to go, with two feet of snow already on the ground. Progress was slow, as each foot had to be carefully placed in the deep footprints of coolies who had made the track the day before.

At last we came to a tiny village and found a ledge to sit on, under the projecting roof of a little grain shed. It was now snowing heavily, and we sat tailor-wise to keep our feet from the dripping icicles. R.'s feet must have been very wet from the mud in the early morning, as even mine were wet through, the snow was so soft. We shared hot cocoa, sardines, and bread and butter with the dogs. It was very hard going for them too, as their feet sank deep in the snow, but Garry especially was his own cheery self.

We started off again just after midday, following the winter path which goes through the small village, and then climbs over the shoulder of a steep hill. R. had told me about the last mile before Sonamarg being through a beautiful meadow. We climbed over the shoulder of this hill, and on reaching the top, saw the meadow stretched before us under four or five feet of snow! Only a tiny track showed in the new snow, as if only one man had gone before us. Many inches of snow had fallen since he had passed, and it still kept falling. The tops of the telegraph poles would have been our guide had there been no track. Our feet were two feet below the snow level, and again each foot had to go in the footprint already made, or sink in and overbalance. Looking up for a second meant a certain fall into the deep snow on either side, and we had several falls before learning to stop dead when looking round.

The bungalow was just visible ahead, but we appeared at times to make no progress. Of course we were unaccustomed to going on snow, and it took us an hour and a quarter to do that last mile; it seemed very much longer.

The bungalow at Sonamarg is built round a little courtyard, and a path had been dug in the snow to the entrance. The roofs were fringed with icicles, and it looked very picturesque.

I put the kettle on the little spirit stove, meanwhile watching for the arrival of our coolies, through the tiny window. They soon appeared, looking like a black thread at first, coming nearer in the blinding snow. A cheery lot they were, and soon had fires burning, and we had a good dinner by half past six. The servants were very tired, so we unstrapped our

bedding and made our own beds. We were late that night; in fact it was nearly eight o'clock before we were in bed. We slept until three, when parasites were again very troublesome; one limb after another in a fever. I am afraid I charred the blankets in several places with lighted matches. The coolies were awake and chattering by 4 a.m. and our tea came not long after.

We dressed; had breakfast, and made all our own preparations by candle-light, and long before sunrise we were on the road. It was a wonderful morning, so still and clear and cold, and the scenery was magnificent. Within an hour the sun was colouring the jagged peaks above us. The pity was that we could never glance up or turn round without halting. The moment we came into the sunshine we had a five minutes' rest, sitting on a waterproof at the top of a rise, and put on our snow goggles.

The continual mental effort to keep our balance, and concentrate on each footprint, used up a lot of energy, and we had gone but a mile and a half. Still we kept at it. R. took a snapshot of Garry and me standing in the snow almost level with the roof of a dak hut.

By half past nine I felt I must stop and have half an hour's rest at least, as I was overbalancing at every step. I tried to call to R., who was only twenty yards ahead, but we were near a stream and sound didn't carry, so on we went until we passed some of our coolies resting under pine trees, when he waited for me. I suggested a rest and a cup of cocoa, but when we actually sat down, we found we were both very ready for a good meal; hot cocoa and a cigarette first however, until we were somewhat rested; then some country meal girdle scones and a tin of herrings—a very good lunch!

A slippery, slushy path for some way, then again walking in the narrow ditch between walls of snow: it was only ten or twelve inches wide. I counted my steps up to a thousand to keep myself going, and found R. had done the same. I didn't want the tiffin coolie behind me to see that I was tired, but I am afraid I kept stumbling. I hummed all the Scotch tunes I could remember—the cheeriest ones first: one hasn't breath for singing at these heights.

A five minutes' rest, then on again. We passed twenty of our coolies resting their bundles on their T shaped sticks: the load rests on the top of the T and relieves them of the weight. After a drink of water R. went ahead, waiting for me at short intervals, as my pace was too slow for his stride, and the dogs followed him, still going well. We were tired after the snowstorm the day before, and if the road had been interesting, it would have been much easier. I thought of many times in illness and in tennis tournaments, when I had almost thought I was down and out, but had managed to keep my teeth together and win, and I said to myself, "Even if you are not brave, it's not courage that's wanted here, just endurance, and you can manage that."

The steep ascent to the bungalow was trying for tired legs. As I looked

back I saw our khansamah slipping in the soft snow and tobogganing to the bottom of the hill : he joined the others in hearty laughter. Wonderful people I thought they were, and I wondered if I would have laughed had I fallen.

It was snowing softly and we were more than glad to have reached Baltal, our destination. It was only one o'clock, but it seemed like late evening to me. It had taken us nine hours to do that nine-mile march. The men kneaded our legs and feet, and we got tea within the hour. Yakdans and kiltas were brought in from the verandah, and stores given out—sugar, lentils, rice, macaroni and potatoes, and R. searched until he found the Keating's powder.

Khazir Butt came in and suggested starting on this march, 2,000 feet up the pass, at 3 or 4 a.m. We planned dinner at 6—then to bed with most of our clothes on. I was glad my hair was not shingled ; it was so nice and warm behind my ears. R.'s was a bit long, but we left it alone until we were out of the snow. Both dogs fell asleep at once, Garry not even taking any notice of coolies collecting their kit on the verandah.

Baltal must be a lovely place in summer, but it was mid-winter when we passed through it, although April 21. The shikari said he did not remember such a late season. There were icicles eighteen inches long all round the verandahs, and great drifts of snow up against the windows on our side of the house.

Our faces were very red, but had not begun to peel. I hoped we had become acclimatized and so escaped peeling, little knowing what the glare off the snow can do.

When I looked at our pillow slips after we had been out for a week, I felt glad they were made of holland ; at least they were brown when we started, and were now only a darker colour.

We looked out our fur caps for next morning. I had an old black Cossack cap, and R. had a sheepskin-lined helmet. Our lunch coolie had been carrying our long Gilgit boots, so that we could change our wet quilted boots and socks the moment we got in. The Gilgit boots are also lined with sheepskin, and come well above the knees. They are a great comfort ; in fact a necessity in these bungalows.

I stopped on a bridge before coming up the hill to the bungalow to look at the view, and the tiffin coolie showed me the entrance to the pass, and where the summer path wound round the hillside far above us.

In the Dak Bungalow book we saw that a sahib had left that morning. He had been held up at Baltal for three or four days by the same storm which kept us prisoners at Gund. The chowkidar (caretaker) told us he had made one or two attempts to get up the pass, but had to return. I was not reassured on hearing this, and again felt afraid that my being there would hinder R. However tired we were, we had to start off next morning without waiting for a day's rest between, in case the weather broke.

V.—The Zoji La.

"Macchoi."

Thursday, April 22.

We are actually through the pass, and it was a real "Hill Difficulty."

I began my diary directly after tea at Macchoi: there was so much to relate. We arrived just before two o'clock, having left Baltal at four in the morning. Our tea was brought before 3 a.m., and we got up at once, and got ready for breakfast. I have not said "dressed ourselves," as we

Fig. 1.—The top of the Zoji La, 11,300 feet. R., the dogs and tiffin coolies.

slept in our clothes. The dogs at first refused to move, wondering what we were doing in the middle of the night. I was too excited to want much breakfast—tea without milk is not very appetizing; but I ate my egg and bacon, with a fried scone.

We started off with our two tiffin coolies and the dogs. It was a lovely night, stars overhead, but dark, and we needed all the candle lanterns. We had had no fire in our room before starting, and in such cold we were glad to be moving.

It was weird in the true sense of the word, and rather exciting, starting for this well-known pass in pitch darkness. Our coolie went in front carrying a lantern. We began to climb at once, and the path was difficult. Each foot again had to be in the track, which was even deeper than before. We wound up the hillside, then crossed a very high bed of avalanche snow, piled hundreds of feet high in great balls, which had formed as it rolled down from the mountain above.

We then turned to the right, and started up the real pass, with high cliffs on each side. Daylight came quicker than we expected, and the candles were put out. The track got steeper and steeper, always deep down in soft snow, and it was still very difficult to balance, even with the help of our long iron-shod khud sticks.

When I think of it, I can still feel the pain in the sides of my feet where the balancing muscles must be. We stopped often for two minutes to get breath and look round. The sun was just catching the ridge behind us, where a sharp peak towered above the others. We crossed avalanche snow again and again, hundreds of feet of it, as we climbed higher and higher. The gorge between the cliffs was extraordinarily narrow, the cliffs overhanging at times. Although in reality the march must have been far harder than that of the previous day, I did not find it nearly so tiring. This march was long and wearing, but full of interest; while from Sonamarg to Baltal was really monotonous.

There was little wind for the first three hours, for which we were thankful; then it began to blow and the snow cut our faces, but we pulled our caps well down and plodded on. I don't know if it can be called "plodding" when we were climbing so steadily; it doesn't seem a suitable word.

Our snow goggles were not put on until we came actually into the sunshine about 8 o'clock, as there was no glare at first.

I thought time after time that we had reached the top of the pass, only to find that round another corner there was a still steeper ascent. We looked for a sheltered spot where we could stop for breakfast, but there was none. The sun was shining, but a freezing wind was blowing, and our hands were so cold that to shell the hard-boiled eggs was almost an impossibility. The butter I ate with a spoon, as it was too hard to spread on the bread. We thoroughly enjoyed our hot sweet cocoa made without milk—a drink that we would not have appreciated in our own house at home.

We sat as short a time as possible, as we were actually sitting in soft snow; there was not a rock or a tree in sight. A good hour before we had seen the last of the birches. Birches are very "homey" trees, and made me think of the Highlands in early October, when the rowan trees are red, and the birches a soft yellow, but these were far up the hillside. We had seen many trunks of fine birches among the debris which had been hurled down from a thousand feet above us by avalanches.

We got up, and shaking the snow from our coats and breeches, followed the long trail again in deeper snow than ever. A steady wind was blowing, and the track was almost obliterated. On one exposed slope we sank deep in driven snow every three or four steps ; it was weary going.

We saw figures coming towards us down the pass, and as they came nearer we were very interested and surprised to see that one was a sahib. R. asked him if he was quite fit as he was going back so early in the season. It transpired that he had gone up on March 26 to Tsurri nullah in Baltistan, had finished his shoot, and got two markhor and two ibex. He asked where R. was going, and said he had shot in 16 block in Ladakh last year, and that it had good burrhel as well as sharpu, and he had also seen Ovis ammon there, probably crossing to other parts. It was all very interesting to hear about where we were going, as our shikari had not been there, and they knew very little about this block in the game office in Srinagar. He asked if I had found the climb very hard, and said, "I think you have done the finest thing of any woman in Asia." This was very pleasing from a man who knew the country so well.

He then told us that a hut was an hour's march from where we were, and that it would take us two more hours to reach Macchoi. We were very glad to get this information.

While R. was talking to him I was stroking his dog, a fine Great Dane, and I saw the owner's name (Stephens) on the collar, and his regiment, Oxford and Bucks Light Infantry. His hair was long and he had a short beard and wore goggles, so it would be difficult to recognize him again. He was very modest, and did not tell us what he had shot, or how long he had been in the nullah. It was not until half an hour later when we met his shikari and a long line of coolies that we knew. He had been only two days in the nullah, and had shot two ibex and two markhor, all fine heads. His shikari said there was so much snow, and so late this year, that the animals had to come very far down to get the young grass which grows where the snow has just melted.

About eleven o'clock we saw the hut in the distance, a black blot on the white background. It was a dirty little place, obviously used by coolies and the telegraph workers. Coils of wire lay there unprotected; no need to keep them under lock and key in such a place at this time of year.

We made tea, and used a lot of our precious methylated spirit, as we had to melt snow in the kettle. It was so cold we made two brews of tea and fried our sardines, and were on the road again within the hour.

We crossed several snow bridges. They seemed wonderful to me; great banks of snow twenty feet above a stream, with the water passing underneath. We also passed over some deep crevasses where a great crack had formed thirty or forty feet deep. Kelpie looked as if he was going to fall into one as we peered down when R. was showing it to me.

We tried singing for a time but we had no breath and the cramped pace at which we were forced to go made it worse. At last we saw the

bungalow on a rising in the middle of the valley. We cheered up, and R. went first to the telegraph office to send a wire to the Game Preservation Office, to ask if he could have the markhor nullah in Baltistan that had just been vacated.

Macchoi Bungalow was quite the dirtiest I have ever been in. I even disliked my feet touching the floor, it was so dirty. However, we were glad of a roof over our heads, and with a big wood fire we were fairly comfortable. I found I had some drawing pins, and pinned up some pieces of dog's blanket where panes of glass were missing in the windows.

We had our legs well massaged and then made tea on our own fire, filling the kettle from the six-foot-high snowdrift in front of the door. The poor dogs were too stiff to move ; Garry was as cross as a tired child. Their feet had been troubling them a lot, I'm afraid. Little lumps of ice got between their toes, and sometimes I noticed little blood marks on the snow.

We did not trouble to tidy up that night as it was a short march next day, but even seven miles in that soft snow are very trying ; quite double the exertion.

We gave the coolies money to buy firewood, and Jit Ram, our bearer, told us that the caretaker had no more wood in his shed. I wondered what we should do if one of us went sick and we had to stay for a day or two. There were plenty of rough wooden bookshelves round the room, so I did not worry.

As we sat round the fire with the smell of wet boots and socks in our nostrils, we thought we had much to be thankful for that day—beautiful views, a cloudless sky all the way, and no wind up the first part of the pass ; a thing we had dreaded. Our faces were very dark that night ; the reflected glare is the strongest for tanning the skin. I kept my back to the fire.

There was no wondering how we would sleep : all the fresh air and exertion, and the mental relief of the pass being now behind us, made us very sleepy. We piled on the beds everything possible for warmth, but the wind howled through the room, and the cold wakened us frequently.

(*To be continued*).

Current Literature.

International Agreement for combating Dengue fever.

Reference was made in a previous article of this series[1] to a draft Agreement, prepared by the Committee of the Office International d'Hygiène Publique, with the object of preventing and combating the spread of dengue, particularly in countries bordering on the Mediterranean. The terms of this Agreement are to the effect that:—

(i) When dengue appears in epidemic form in one of the countries participating in this Agreement, the chief health authority of the country in question will notify the fact to the other participating countries. It will also keep the Paris Office informed of the progress of the epidemic.

(ii) When the existence of an epidemic of dengue has been established in a port or in a district adjoining, the sanitary authority of the port shall recommend the captains, or ships' doctors, if any, to carry out immediately after departure from the port a search for and destruction of mosquitoes and their larvæ in all accessible parts of the ship, especially in the cabins, crews' quarters, store-rooms, kitchens, stoke-holds, water-vessels and any places particularly likely to harbour mosquitoes. The sanitary authority of the port shall request the doctor, or alternatively the captain, to take all measures necessary so that if any cases of dengue occur on board the patients may be isolated under such conditions that they cannot be bitten by mosquitoes.

(iii) Any ship, coming from a port where there is an epidemic of dengue and arriving in a port whose sanitary authority has reason to fear that the disease may spread, by reason of the presence of a large number of mosquitoes capable of carrying the disease, may be subjected to the following measures:—

- (*a*) Inspection, including a reply from the doctor, or else the captain, to the question: "Are there, or have there been, any persons on board suffering from dengue?"
- (*b*) Medical examination. Patients who have been suffering from dengue for less than five days and who wish to leave the ship, shall be disembarked by day and isolated on shore, in accordance with instructions of the competent sanitary authority, under conditions in which they are protected from the bites of mosquitoes, until five days have elapsed since the beginning of the illness.
- (*c*) Inspection of the ship for the purpose of ensuring that no stegomyia exist on board, with the reservation that account is

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[1] Vide this *Bulletin*, 1932, v. 7, 610.

taken of the measures which have already been taken en route. If stegomyia are discovered on board the sanitary authority may take action to secure their destruction.

(*d*) In exceptional cases the sanitary authority of the port may, if it judges this procedure necessary by reason of the circumstances, place the passengers who have disembarked under surveillance, and confine the crews on board until eight days have elapsed since their exposure to risk.

(iv) On land frontiers, passengers may be put under surveillance for eight days since exposure to infection. Those suspected to have had dengue less than five days ago may be isolated, in such a manner as to avoid their being bitten by mosquitoes, up to a period of five days from the beginning of the illness.

(v) The measures prescribed in sections iii and iv above are to be regarded as a maximum.

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GLOVER, J. ALISON, and WILSON, JOYCE. **The End-Results of the Tonsil and Adenoid Operation in Childhood and Adolescence.** *Brit. Med. Journ.* 1932, September 10, 506-12, 2 diagrams. [41 refs.]

In London the number of tonsillectomies in Public Elementary school children has risen from 7,656 in 1923 to 18,119 in 1930, and in 1931 the number was 18,178. In England and Wales the number is still increasing; there were 109,738 in 1930 as against 97,518 in 1929 and 47,685 in 1923. It is estimated that approximately 14 per cent of elementary school children in England and Wales are tonsillectomized before reaching the age of 14, in London the percentage is about 33, while in a number of public schools of this country the figures show that more than half have had a tonsillectomy.

A review of the literature suggests that, with the exception of diphtheria, the incidence of the ordinary infectious diseases is unaffected by tonsillectomy. The evidence with regard to the prophylactic and therapeutic end-results on acute rheumatism, chorea and carditis is confusing. There is no sufficient case for the routine removal of apparently healthy tonsils in a rheumatic child, simply as a measure of prophylaxis. Removal should only be undertaken if there is some definite indication.

A careful attempt is made to estimate the effect of tonsillectomy on the incidence of respiratory infections from observations in 27 large boarding schools and 2 large day schools, covering a population of some 14,000 pupils chiefly between the ages of 13½ and 18 years. Slightly more than half the pupils had been tonsillectomized and the sickness incidence was compared in those with and without tonsils. Some of the observations cover a period of seven terms, whilst others are confined to certain terms of epidemic prevalence. These interim observations give no statistical

support to the theory that the removal of tonsils closes an entrance for infectious or respiratory diseases. To give one example, in the boys' boarding schools there were 8,263 boys, and of these 4,552 or 55 per cent were tonsillectomized. In the Lent term 1932 there was a sharp epidemic of influenza in most of the schools. The total nasopharyngeal infection rate was 43·5 per cent in the tonsillectomized group and 42·1 per cent in the non-tonsillectomized group. The authors point out a possible fallacy in this comparison, that the former group may contain more of the delicate and ailing children and the latter may consist of more boys with a high natural resistance. "Yet when more than half the school is tonsillectomized it is obvious that no real selection can have taken place, and that one is almost as likely to find the strong and healthy in the tonsillectomized group as in the other."

The authors conclude from a study of the literature and the data from schools that "the excellent end-results of tonsillectomy in selected cases have been statistically overweighted by indifferent end-results in cases in which the operation has been performed without sufficient indications as a more or less routine prophylactic ritual. In our opinion, a large proportion of the tonsillectomies now done in children are unnecessary, entail some risk, and give little or no return." [See also this *Bulletin*, 1931, v. 6, 328, 794-917; 1932, v. 7, 550.]

H. M. Woods.

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Reviews.

The Relative Value of Radiotherapy in the Treatment of Cancers of the Upper Air-passages. By W. Douglas Harmer, M.A., M.B., M.C. (Cantab), F.R.C.S. London: John Murray. 1932. Pp. vi + 85. 6s. net.

This small book of eighty-five pages with fifteen illustrations is the University of London Semon lecture delivered by the author at the Royal Society of Medicine on November 5, 1931. Mr. Harmer has done a distinct service to the profession in presenting his lecture in this handy little volume.

Radiation must still be regarded as on its trial in the treatment of malignant disease; the regions of the body to which deep X-ray therapy and radium can be applied and the technique of their application are still the subject of much controversy. Consequently, a careful and reasoned account, as this is, of the author's extensive experience of the value of radiotherapy in the treatment of cancers of the upper air-passages is a valuable contribution towards the solution of the problems of this important

subject. Full justice is done to the work of Finzi, Canti, Hopwood and Levitt on the subject.

A careful account of the uses and value of both deep X-ray therapy and radium as applied to the larynx, mouth, sinuses, etc., is given.

The operation of fenestration of the thyroid cartilage so as to permit of the close application of radium needles to a growth in the larynx throughout the whole of its extent is made clear by excellent illustrations.

This little book is a mine of wealth regarding what has been accomplished up to date in the treatment of malignant growths of the upper air-passages, and the author's own views are clearly and emphatically expressed. These views show a well-balanced judgment, and no extravagant claims are made for radiation methods as opposed to surgery, but a combination of both methods is advocated in appropriate cases. The results quoted by the author bear out his opinion as to the value of these forms of treatment in his hands.

The lecture concludes with a strong plea that radiotherapy should never be employed without the help of a group of experts. The further experience that has been accumulated in the year that has elapsed since this lecture was delivered strongly supports this view.

Extensive tables are given at the end of the book showing the results obtained by a large number of workers on the subject and, together with a very full bibliography, make this small book a valuable work of reference. Both the printing and illustrations are excellent and reflect credit on the publishers.

This little book can be strongly recommended to all who are interested in this intricate and fascinating branch of surgery. J. W. W.

SYNOPSIS OF SURGICAL ANATOMY. By Alexander Lee McGregor, M.Ch.Edin., F.R.C.S.Eng. Bristol: John Wright and Sons, Ltd. 1932. Pp. xiv + 609. 17s. 6d.

A fascinating book of 609 pages, well illustrated in an original manner, fully indexed, and of handy size.

The Foreword by Sir Harold J. Stiles, K.B.E., F.R.C.S.(E.), the great Edinburgh surgeon and teacher, should be sufficient recommendation for this splendid book. The reviewer has often heard Sir Harold Stiles say that he " knew Gray's Anatomy from cover to cover, before he embarked upon the preliminary studies for his medical career."

A glance at many of the headings of the chapters will indicate the original way in which the editor has approached the subject. The first part is confined to the Anatomy of the Normal—here are contained chapters on 'The Anatomy of the Child', 'Hilton's Line', 'Lengths', 'Important Levels', etc.

The second part discusses 'Anatomy of the Abnormal', with chapters on 'Congenital Errors', 'Nerve Injuries', 'Anatomical Bases of Clinical

Tests', 'Anatomy of Certain Diseases', and 'Anatomy of Surgical Procedures', etc.

The semi-diagrammatic illustrations in black and white are clear and well annotated.

It would be difficult to find a more refreshing and fascinating book on a rather dry subject.

CATECHISM SERIES: ANATOMY (UPPER EXTREMITY), PART I. By C. R. Whittaker, F.R.C.S.E., F.R.S.E. Fourth Edition. Edinburgh: E. and S. Livingstone. 1932. Pp. 80. 1s. 6d.

This small paper-covered booklet has been revised and enlarged. The printing is excellent and well contrasted, with free use of the old nomenclature in brackets.

To those who want to run over their anatomy quickly by the "catechism" method, this first part of the new edition will be a welcome precursor to the other parts to follow.

A SHORT PRACTICE OF SURGERY. By Hamilton Bailey, F.R.C.S., and R. J. McNeill Love, M.S., F.R.C.S., in two volumes (1005 pages), price 20s. each. London: H. K. Lewis and Co., Ltd. 1932.

There are 618 illustrations, of which 75 are coloured.

The first volume deals with septic conditions, wounds, blood-vessels, lymphatics, muscles, face, neck, breast, genito-urinary system and limbs; the second volume with the abdomen, head, spine, nerves, thorax, tumours, skin and specific infections.

Two sizes of type have been employed, the smaller type being reserved for the more advanced surgery and for the rarer conditions. The general make up of the volumes is very good. The print is clear, and the illustrations and diagrams are excellent. The authors state that they have "endeavoured to include only such material as is recent or which has been generally accepted." They have dealt with a large subject in a very clear, comprehensive and concise manner, and they have succeeded in producing two very readable and instructive volumes which should be of considerable assistance to students and practitioners. The treatment of fractures and dislocations is well described; but one might criticize the treatment of excision advocated in cases of dislocation of the semilunar bone; if treated early this is usually reducible by manipulation with good functional result. The chapters devoted to surgery of the abdomen, head and spine are especially deserving of commendation.

As a whole this short practice of surgery is written in a very attractive style and with great discrimination.

Notices.

THIRD INTERNATIONAL HOSPITAL CONGRESS AT KNOCKE-SUR-MER (BELGIUM), JUNE 28 TO JULY 3, 1933.

THE International Hospital Association invites to this Congress all Officials, Associations, Institutions, and persons who are interested in the construction, administration, and development of hospitals. The world crisis has placed the tasks which the hospitals of our day have to fulfil in such a strong and clear light that it has become more than ever necessary for different countries to exchange views and come to an international understanding of how important questions should be dealt with. The reports of the ten *International Study Committees* will be laid before this Congress. These have been arrived at by international exchange of views by outstanding specialists of different countries. These reports will in part contain suggestions for common international principles, their purpose being not to form one uniform system, but to bring about a general perfecting and improvement in the hospital system.

The references for these committees are: (1) Construction; (2) Equipment and technique; (3) Administration and house-keeping; (4) Finance and book-keeping; (5) Legislation; (6) Care of the patient in the hospital; (7) Patients' food; (8) Personnel; (9) Statistics; (10) Outside connections with the hospital.

The opening sitting of the Congress will take place on Wednesday, June 28, at 5 p.m. The reports of the committees and sub-committees will be presented on July 29 and 30, but will be fully discussed at the plenary sitting on July 1, 2 and 3. The results arrived at the full gathering will be forwarded to the League of Nations and the respective Governments.

From July 4 to 9 there will be a five days Study Journey through Holland, which will enable the Congress not only to see the new hospitals but the classic places, the centres of industry and scenery of Holland.

ADVITA AND ESSOGEN.

Advita and essogen are concentrates of vitamins manufactured by Lever Brothers, Ltd., Port Sunlight.

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liver oil is generally prescribed, and its advantages over the oil are the high potency in vitamins A and D, and the ease of administration.

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Essogen is put up in 2-minim capsules.

COW AND GATE MIXING MEASURE.

We have received a sample of this Mixing Measure which is designed so that the Cow and Gate Feeder fits into it.

The Mixer, of British manufacture, is strongly made of excellent enamel ware, and is graduated in pints, ounces and tablespoons.

We can confidentally recommend the article for the purpose for which it has been designed.

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The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

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A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, Journal of the Royal Army Medical Corps, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the Journal of the Royal Army Medical Corps is £1 payable in advance. Single copies, 2s. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

Communications in regard to subscriptions, change of address, etc., should be addressed "The Manager, Journal of the Royal Army Medical Corps, A.M.D.2, War Office, Whitehall, London, S.W. 1."

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Journal
of the
Royal Army Medical Corps.

Original Communications.

THE STORY OF A SMALL CAMPAIGN: THE MEDICAL ARRANGEMENTS DURING THE BURMA REBELLION, 1931.[1]

BY MAJOR-GENERAL J. W. WEST, C.M.G., C.B.E., K.H.S.

Abstract.—(1) A general description of Burma, its climate and seasons.—(2) The medical experience of former campaigns in Burma.—(3) Medical resources available and methods adopted to preserve the health of the troops, with special reference to accommodation, water supplies, malaria, heat-stroke and venereal disease.

THE Burma rebellion of 1931 was a very small campaign if judged by the number of troops engaged and the battle casualties, but it is of interest, as the operations took place in a notoriously unhealthy jungle country, and owing to the wide dispersal of the troops the medical arrangements differed materially from those employed with large bodies of troops operating in Europe.

Description of Burma.—Burma lies between 10° and 26° North latitude. It is 1,300 miles long, 500 miles broad, and has a total area of 230,000 square miles, or roughly four times the size of England.

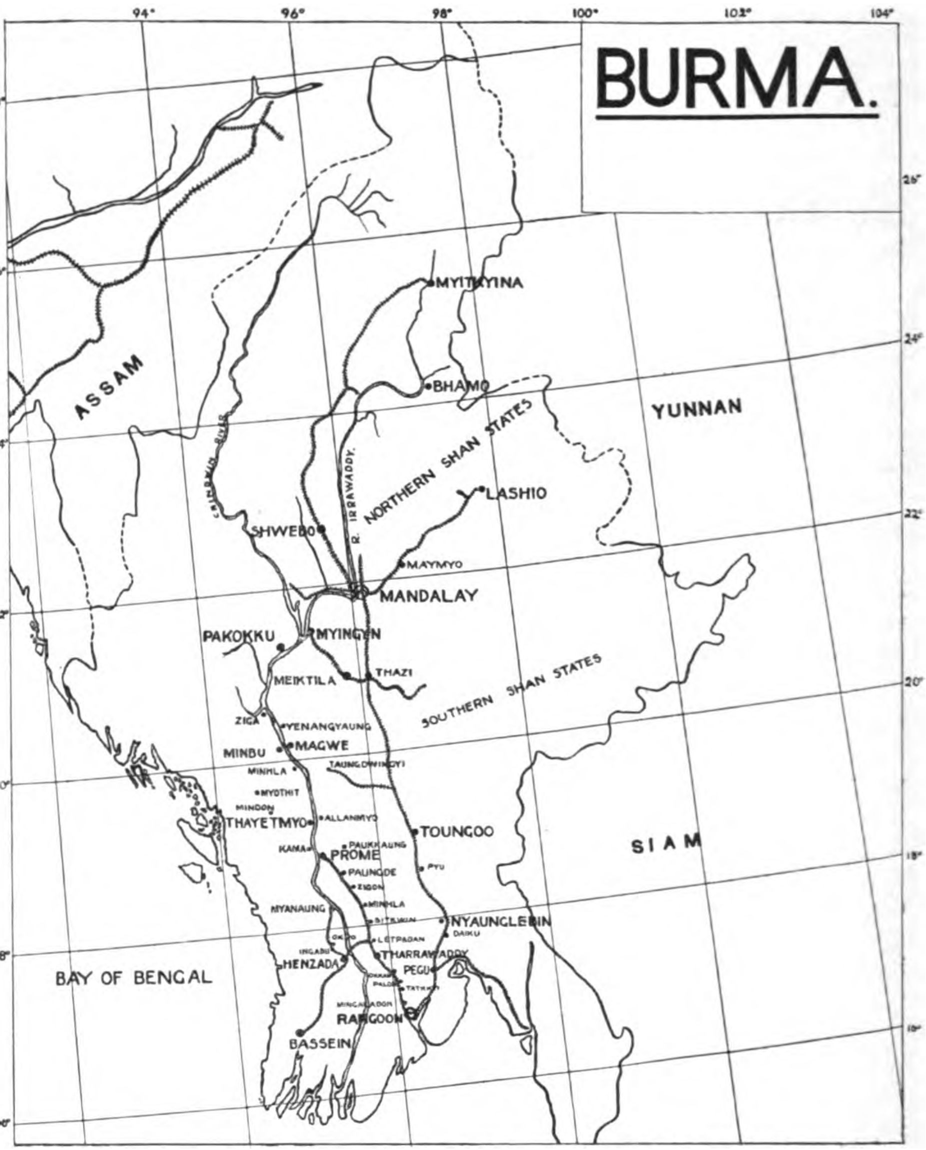
There are two main seasons, the wet and the dry. The monsoon lasts from the end of April until October. The rainfall during this period is very great, varying from 200 inches in Arakon to 90 inches in Rangoon. The area north of the Toungoo—Thayetmyo line is known as the dry zone; this is a comparative term, as during the monsoon heavy rains occur in this area.

The temperature in Burma is never so high as in parts of India, the average mean being 82° F. Temperatures of 106° and 107° F. are, however, met with at times; the saturation of the atmosphere is always excessive, and a temperature of 90° F. can be very uncomfortable.

[1] A paper read before the United Services Section of the Royal Society of Medicine and reprinted by permission.

Communications.—The plains are intersected by the Irrawaddy, which is navigable by good-sized river steamers for 900 miles (as far as Bhamo).

A main line of railway runs from Rangoon to Mandalay, and after crossing the rivers by ferry the journey can be resumed as far as Myitkyina. Several branch



lines run off this main line, e.g., from Mandalay through Maymyo to Lashio, one westward through Meiktila to Myingyan, and another from Pinmana.

A main line runs from Rangoon to Prome on the river, and on the western side of the river a railway runs from Bassein through Henzada to Myanaung.

Roads.—Outside the towns there are very few roads. In fact there is really only one good road which joins Rangoon to Prome, and one other which runs from Mandalay to Maymyo, otherwise they are only tracks impossible for wheeled traffic except in the dry season.

Experiences of former campaigns in Burma.—These have all shown very heavy casualties from disease. The first Burmese War in 1824 ended inconclusively from this cause. The condition of the troops was described as pitiable, and 3,115 of a force of approximately 7,000 men died of disease during the year of the campaign.

During the second Burmese War in 1852-3, although better arrangements were made for the health of the troops, the casualties were very heavy. In the attack of the fort in Rangoon cholera broke out, and fifty cases occurred the first night, in forty-seven of which the patients died before morning. In a march of twenty-four days carried out by Brigadier-General Sir John Cheape with 1,150 men, 230 men died, of whom 100 died from cholera.

Lower Burma was permanently occupied by the British as a result of this campaign.

As a result of the third Burmese War in 1885, King Thebaw was taken prisoner and deported to India. The first part of this campaign was a mere procession, the troops being moved by river to Mandalay. The final pacification of the country did not, however, take place until 1889, and by this time 25,000 troops were employed. No official statistics of the sick and mortality rates for these operations were published, but, judging by the cemeteries dotted over Upper Burma, they must have been very heavy.

The recent rebellion broke out when, in the latter months of 1930, dacoities were becoming more and more frequent in the area of Tharrawaddy, about sixty miles from Rangoon, and on December 26 the Government of Burma asked for troops to aid the civil power. These were dispatched, and in a few weeks were scattered over numerous posts, extending from Rangoon to Prome.

The trouble spread and it became evident that reinforcements from India would be necessary. Finally, in June, the 12th Infantry Brigade and Auxiliary Troops and Medical Units arrived in Burma. By July the rebellion was in full swing and the troops were scattered in over 60 posts from Shwebo in the north to Bassein in the south.

Medical arrangements.—At the outbreak of the rebellion the medical resources in the country were very limited. Good British and Indian military hospitals existed at Mingaladon, 12 miles from Rangoon, at Mandalay and at Maymyo.

The only mobilization arrangements were that the medical and ordnance equipment of seven sections of field ambulance were in store in Mingaladon and Maymyo, but no transport or personnel was available. Strict orders existed that the equipment must not be used except on mobilization, which would take place after ninety days.

Medical staff consisted of an Assistant Director of Medical Services and a Deputy Assistant Director of Pathology who ran the District Laboratory. For reasons of economy Burma had had its sanitary officer withdrawn.

Troops available.—Two British Infantry Battalions, less one Company in the Andamans, and four Indian Infantry Battalions with a Company of Indian Sappers and Miners and an Indian Mountain Battery were doing duty in Burma, but not all of

these were available for duty in the field. The big towns and the arsenal at Mingaladon Cantonment could not be left without troops. One of the active battalions of the Burma Rifles stationed at Mandalay was ineffective; the reasons for this illustrate the unhealthy nature of the country.

There are four active battalions of Burma Rifles, two of which serve overseas, one in India, and one in the Malay States.

When a regiment returns from abroad, the men are given furlough in two large batches. To reach their villages these men travel on foot for several hundred miles over most malarious country. The first batch had just got back and to a man were either ill in hospital or attending hospital with malaria, dysentery, venereal disease or skin trouble. Previous experience had shown that at least two months would elapse before the unit was fit. The question of furlough in the unhealthy season had caused much controversy between the Medical Directorate and the Staff, but the season of relief and the necessity of having the men back for the next training season had prevented any change being made.

At the first staff conference, the Civil Government and the heads of the Civil and Military Police being present, it emerged that—the police were unable to cope with the situation and the G.O.C. Burma was asked to supply the troops necessary to aid the Civil Power.

The staff decided that operations must be carried out during the monsoon although the casualties from sickness were likely to be heavy.

At this stage, in addition to the usual sanitary precautions recommended to safeguard the health of the troops, special stress was laid on three points: (1) efficient shelter against the elements; (2) safe water supply; (3) prevention of malaria.

Administrative medical difficulties in the early stages.—The most serious was to find medical personnel to man the scattered posts. Regiments were broken up into company and platoon posts over, at times, 100 miles. The existing hospitals were depleted to the danger point, but later the D.M.S. in India supplied extra sub-assistant surgeons and Indian Hospital Corps personnel.

When the possibility of a new brigade from India was mooted an appreciation of the medical situation was sent to Simla. As no evacuation of sick from Burma was contemplated, it was considered that a daily sick rate of five per 1,C00 fairly represented the situation and on that basis 200 additional beds for Indian troops and 75 for British troops would be required. A Sanitary Section was asked for and a D.A.D. of Hygiene to strengthen the staff of the A.D.M.S.

When the new brigade arrived from India in June it was accompanied by 200 beds of No. 3 Indian General Hospital, 100 beds of No. 8 British General Hospital, the personnel and motor ambulances of 28 Field Ambulance, No. 14 Sanitary Section and an experienced D.A.D. of Hygiene.

Utilization of these medical units.—The existing military hospitals were expanded, 100 Indian beds being left at Mingaladon and Rangoon and the Indian military hospitals at Mandalay and Maymyo were also expanded. A complete unit of fifty medical beds was sent into reserve at an old cantonment at Meiktila. Fifty British beds were sent to Maymyo and the British military hospital at Mandalay was extended from twenty-three to fifty beds. The remainder of this unit was sent in reserve to Meiktila.

The main difficulty was how to utilize the Field Ambulance. It could not act normally with the widely scattered posts. At first one section was left at Mingaladon and the remainder went to Meiktila.

The Sanitary Section was a serious problem. As such a unit does not exist in peace time in India, it had been hastily got together ; all the Indian personnel were enrolled and put into uniform the day before they left India. Apart from the officer in command and the two R.A.M.C. N.C.O.'s, none had had any previous training. The six British other ranks from British regiments had had no real sanitary training. Half the unit was left at Rangoon under its officer and the remainder sent to Maymyo for training under the D.A.D. of Hygiene. Eventually the unit was very useful in clearing up old cantonments and the British personnel were invaluable for water duties.

Arrangements to deal with sick at the various scattered posts.—At every post a detention hospital was formed, varying from two to sixteen beds. These were in existing buildings, or in excellent matting and thatched buildings provided by the R.E. As the Arsenal and R.E. had no material to equip these hospitals in the early stages it was sent out from existing military hospitals, which then indented to replace the material lent. These military hospitals acted as parents of all detention hospitals, and all returns were rendered through them. The detention hospitals saved much wastage, and experience showed that it was better for a case of malaria to be detained for a few days than to be evacuated with high fever. No deaths occurred from malaria, and I consider that this policy was largely responsible.

Decentralization of control.—Until the arrival of the brigade from India all medical arrangements were directed by the A.D.M.S. from district headquarters. This soon became impossible and all local arrangements were placed in the hands of the senior medical officers at Rangoon and the Thayetmyo area.

Evacuation of cases.—The evacuation of sick and wounded from posts on the railway from Rangoon to Prome presented no difficulties. Trains ran twice daily and good accommodation was reserved on the ordinary trains. When sufficient cases required transfer to hospital, a special bogey coach with lying-down accommodation was available to attach to any ordinary train, and motor ambulances on good roads were available to transfer the cases to the military hospital at Mingaladon. Sick-attendants accompanied the trains.

From the opposite side of the river, where all the posts were again on the railway line, evacuation to Rangoon and Mingaladon presented no special difficulties. There were two main detention hospitals: one at Bassein and one at Henzada. From Bassein a comfortable river steamer of the Irrawaddy Flotilla Company ran daily, and reached Rangoon in twelve hours. Cases were met at the docks and conveyed by motor ambulances to the 30-bed hospital at Sale Barracks, Rangoon. This, if full, passed cases on to Mingaladon, twelve miles away, by good road. It was quicker to send cases from Henzada across the river by a big and comfortable steam ferryboat and then entrain them at Tharrawa. The whole journey to Mingaladon was accomplished in twelve hours.

Before a general hospital was established at Thayetmyo cases from posts on the river were shipped from these posts in the daily Irrawaddy Flotilla steamers, those from south of Yenangyaung going to Prome, where the boat runs alongside the train, and thence to Mingaladon by train. From posts in the northern sector of the river

cases went by boat to Myingyan and thence a six hours' journey by rail to Mandalay. There was a good detention hospital at Myingyan.

From posts on the main Rangoon-Mandalay railway cases went by train to Mandalay or Rangoon—whichever was nearer.

Owing to the operations being confined mainly to the southern sector of the railway, the hospital at Mingaladon had from time to time to be relieved of both British and Indian patients, who were comfortably conveyed in special carriages with lying-down accommodation to Maymyo, a semi-hill station at a height of 3,500 ft., where the temperature is considerably lower, and these patients convalesced well. This journey occupied about twenty hours.

Collection from field posts not on the railway and river.—This was much more difficult, owing to the absence of proper roads. During the monsoon wheeled transport could be used only to a limited extent.

The difficulties are well illustrated by the operations in the Thayetmyo area. This was a very disturbed area and the G.O.C. decided to have a drive through it from north to south. On the south a semi-pukka road ran out to Yemyet, and the Sapper and Miner Company with a Company of the Pioneer Regiment, after strenuous work, often up to their waists in water, made it fit for wheeled traffic out to Mindon. On the north the track, for it was not a road, could not be made fit for any sort of wheeled traffic during the monsoon. Some of our troops on this road which runs west from the river at Minhla were fifty miles from any suitable form of transport, and three columns were to operate south getting ever further from roads and river. The O.C. 28 Field Ambulance, in medical charge of this area, arranged a series of rest posts along the route to Minhla, thirty-five riding ponies were available which did good work for sick who could sit on a pony. Some cases had to be carried by hand from post to post and accommodated at night at the rest stations where good cover was provided and medical personnel available. Local labour was often employed as stretcher squads. The difficulty was enhanced by the fact that no small party could move without an escort of rifles, as the rebels did not recognize the Red Cross.

Before the Pani Chaung to Mindon was bridged, some cases came down by small country boats through tortuous creeks, and on one occasion a launch found one of these with a delirious officer on board who had then been four days on the journey. On the river were well-organized detention hospitals and a general hospital now functioning at Thayetmyo, where cases could be retained until fit for evacuation by river and rail to established military hospitals.

In the later stages of the sweep through the Pegu Yomas the rains were over, and my successor informs me that six-wheeled motor ambulances did good work often making their way right over the paddy-fields. Elephants were also used for a short time in the later stages and did good work.

Throughout the operations there was never any breakdown in the evacuation of sick, and much credit is due to the resource and initiative of all the medical staff responsible for the arrangements. There was never a shortage of hospital beds and, by transfer of special cases and convalescents up country, room could always be made where required. The section of No. 3 Indian General Hospital established in a large barrack room in the old cantonment at Thayetmyo had a British wing where both officers and men could be accommodated, and did excellent work. Later, in the

final drive, this hospital was moved southward to Prome, leaving a small unit at Thayetmyo, and as the monsoon was over was established in excellent tentage.

Measures to preserve the health of the troops in the field.—*Accommodation.*—Indian pattern tents, or indeed any tents, are valueless as shelter against the monsoon rains of Burma; the Burman puts his dwelling upon stilts to be above the water. In some of the posts in the main villages the barracks occupied by the military police were available, but these were never sufficient to house the troops, and in most cases were unfavourably situated in the centre of the villages. Crowds of native women and children lived in close proximity, and in many cases the area was surrounded by the refuse dump of the town.

We insisted that at all these posts huts must be erected, raised above the ground, and thatched to keep out rain. The magnitude of this project was rather staggering at first, but a preliminary survey showed that it was an absolute necessity.

In most of the posts these huts were admirable in every way; raised about 10 ft. above the ground, the area below was made a stronghold by earth walls between double boarding; thatched so that rain was kept out, and with flap windows of matting.

Another valuable feature of these huts was they could be wired for mosquito nets, the use of which was rigidly enforced. Huts were not necessary at all posts, as in some areas court-houses, rest-houses, etc., could be used for small parties. In addition to the huts the usual ablution, latrine and cookhouse accommodation was also provided. The construction was carried out by the P.W.D. acting for the C.R.E. and was well and promptly done.

One other important item to safeguard the health of the troops was also provided in all main posts, and this was drying-rooms for clothing. These were made of corrugated iron, wired to hang clothes and heated by charcoal braziers.

I attribute much of the freedom from sickness to the care that was taken to promote adequate shelter and drying facilities.

Conservancy.—A wide variation exists in the methods of conservancy in the cantonments of Burma. At our newest cantonment at Mingaladon there is water-borne sanitation with disposal through a septic tank which acts well. At Mandalay, which is in the dry zone, there is a bucket system of latrines with removal and incineration in the cantonment. At Maymyo incineration has been tried, but owing to the heavy rains in that area in the monsoon it was found impracticable, hence removal and shallow trenching at an area about two miles from the barracks was adopted. In British barracks the latrines are fly-proofed. For the Indian type of latrine, no satisfactory fly-proofing has yet been devised and crude creosol was used to prevent the fly nuisance.

When field operations began, it was found that all the larger villages on the Rangoon Prome line had a bucket-removal system and through the local deputy Commissioner arrangements were made for removal by the municipal contractors. All the public village latrines appeared to be grouped round the police barracks and court-house, and the plague of vicious flies was very bad. After much protesting to the civil authorities some latrines were removed, and others closed, but to ensure reasonably safe sanitary conditions we had to supervise these with military personnel. The C.R.E. provided satisfactory latrines at all posts, after some initial difficulty about receptacles. The cost was considerable, although only posts and matting

and a mat roof were supplied, but owing to changes of posts from Indian to British troops—necessitating complete alteration in the type of latrines—the cost was increased. Even in isolated posts latrines were supplied unless occupation was very temporary—deep trench field latrines were used in this case. We insisted that any post occupied for a month should have semi-permanent latrine buildings and a removal system.

In view of the fact that the spread of dysentery is commonly attributed to latrines unprotected from flies, it is interesting to note that the incidence of dysentery was below that for the Burma District in the preceding year. All the old cantonments at Shwebo, Meiktila and Thayetmyo had good stone-built latrines which only required reconditioning; in Meiktila incineration was employed.

When the 12th Infantry Brigade, after the monsoon, went into camp at Prome, incineration was employed.

Owing to the difficulty of using transport, the number of animals at any post was never great. There was, however, a considerable collection of mules from India at Mandalay, and it was here only that stable litter was accumulated in any quantity. Tight packing in prepared areas was employed for a time, and it was found that if at every dry interval the manure heap was fired and left to smoulder, no flies developed. In Thayetmyo stable litter was disposed of in deep trenches. The Company of Sappers and Miners assisted in the preparation of these trenches.

Water supplies.—All the permanent cantonments in Burma have now an adequate and safe supply of water either from deep tube wells or from mountain springs collected in safeguarded catchment areas and need give no further concern. Outside these cantonments no water supply is safe, most of the supply in the country districts being from shallow wells of the worst type. In some of the larger villages the public well was walled in but no sanitarian would regard the water as safe.

In the old cantonments which we re-occupied, water-supply was also a serious problem. At Shwebo it was from a moderately deep shallow well. The first one tried gave saline water, but a second was opened and deepened and a good supply was secured after treatment. At Thayetmyo, where the old cantonment was served by many wells scattered through the barracks, the wells had either been filled in or had ceased to yield water, we therefore had resource to the Irrawaddy, now, in the monsoon, a thick muddy stream. Hand pumps were arranged, worked by jail labour, and an ample supply filled the cantonment tanks. In the final stages of the rebellion when the 12th Infantry Brigade moved south from Thayetmyo to Prome, the river was again our supply.

At Meiktila—which is looked on as one of the health resorts of Burma—where we formerly had many troops, and where during the European War there was a large Turkish prisoner-of-war camp, there was a well-constructed sand filtration installation to deal with the water pumped from a large lake. I had inspected this place more than once before the rebellion. I found the duplicate set of filter beds both in use at once and was told that this was because not enough water would get through if only one was used. I asked what happened when not enough got through the two beds and the old Burman in charge proudly produced a long bamboo pole and demonstrated how by pushing this into the sand layer the flow was at once increased. Under trained supervision these filter beds provided a safe but at times limited supply for the number of troops in the cantonment.

The military arrangements for carrying and purifying water in the field in India have none of the refinements of the Home Army. No water-cart of any kind exists and the old skin mussack is not obsolete, although the kerosene tin has largely taken its place. On the march, in addition to the men's water-bottles, water can only be carried in mule pakhals holding 5 gallons each. Arrangements had to be made for receptacles in which water could be clarified and chlorinated. At every post occupied for more than fourteen days the C.R.E. supplied galvanized iron tanks, which he purchased in Rangoon. These were arranged in series so that water could first be clarified by alum, or by the special clarifying powder supplied, and then run into another tank for chlorination. In the larger cantonments duplicate batteries of large tanks were provided. Here we experienced our first real difficulty. There was so much mud in the Irrawaddy water that after clarification a deposit of nearly 6 in. was found in the tanks instead of the few inches expected; the outlet pipe had been placed too low, and before the tanks would function properly the pipe had to be moved so as to be a foot above the bottom.

The first lot of tanks supplied had no vent in the bottom to clear out the deposit and others were set up on a solid base, so that the scouring out could not be done until they had been moved on to wooden framework stands. When one set of tanks was moved from one post to another a report was received that to unscrew the washing-out plug a man had to get into the tank. It was then discovered that the taps had been moved from the outside and screwed on inside to prevent damage in transit. At first alum was used for sedimentation, and later a special clarifying powder. Our estimate for clarifying powder, which had to be imported from India, was a ton a month to supply all posts where clarification was necessary.

Chlorination gave rise to many difficulties, largely from the poor quality of the bleaching powder supplied. Some tins gave as little as 2 per cent. of available chlorine; even the supply in glass bottles varied very much. Both types of container were far too big, and once opened deteriorated rapidly in the hot moist climate of Burma. I strongly advocate the supply of small wide-necked bottles containing not more than a few ounces. It was realized at once that no safe water supply for posts could be ensured if the preparation was left to the regimental authorities, and consequently, the supervision and sterilization of water supplies was undertaken by the medical personnel at each post.

At large cantonments the water arrangements were undertaken by the European personnel of the Sanitary Section. In the smaller posts it was done by the assistant surgeon, the sub-assistant surgeon, or the nursing orderly of the Indian hospital corps if neither of the first two was available.

These were all especially trained in the use of Horrocks' box, and the work was well and faithfully done.

Within a few weeks of the opening of the campaign the district was short of Horrocks' boxes and Lt.-Col. Tabuteau improvised sets which were carried in a small japanned tin box bought for one rupee eight annas in the bazaar; there were enamelled tin mugs graduated on the inside as measures, and the necessary reagents in bottles. These served the purpose well. When a small post moved suddenly, or a body of troops was on a raid, tanks could not be carried. If the number of troops was greater than could be supplied from the pakhals, Willesden canvas tanks were supplied which could be readily carried on pack mules and set up on the ground with

wooden pegs, and these answered well. No post or body of troops ever had to drink unprepared water, and to this must be attributed their freedom from water-borne diseases. The report of the health of the Army in India shows for Burma a decrease in dysentery from the previous year when the troops were all in cantonments.

Twenty-two cases of the enteric group of fevers occurred in the troops in the Thayetmyo area, and two in one other district, but an extensive investigation failed to trace this to water supply or to a carrier amongst the cooks or water-carriers. It was, of course, not possible entirely to prevent Indian troops buying food from the inhabitants. These were the only areas in which an outbreak of the enteric group of fevers occurred.

YEAR 1931. BRITISH OTHER RANKS. MALARIA.

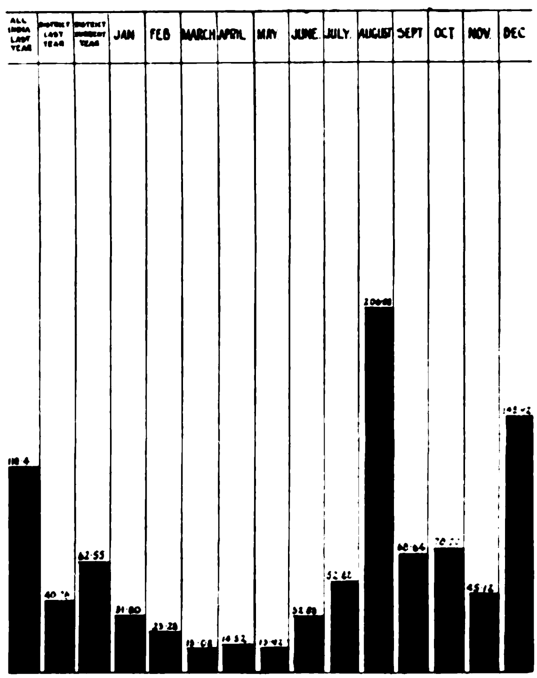


CHART 1.—Showing equivalent annual ratio per 1,000.

There were no cases of cholera, in spite of the fact that cases were occurring amongst the civil population in the areas occupied by troops. This result forms a marked comparison with the outbreaks in former campaigns over the same area.

The results obtained show that carefully supervised water purification, even if the methods are crude, can reduce water-borne diseases to the vanishing point.

Malaria.—A study of the previous campaigns and a knowledge of the incidence of the disease in the jungle of Burma led us to expect that a serious loss of man-power would occur if the troops were employed in the jungle in the monsoon period. Malaria is always present; it is at its worst during the periods just before and, especially, just after the monsoon, when the drying-up process is going on. Some

of the posts that we occupied had a very bad reputation. For instance, Mindon, close to the Arakan Yomas, was reputed to be so bad that the local inhabitants deserted it in the worst period of the year. The employees of the timber firms, whose work lies in the jungle, suffer much from malaria.

In the training battalion of the Burma Rifles many recruits are rejected on account of massive malarial spleens, and we always treated every recruit by quinine for two months after arrival at the Depôt. Apart from fresh infections, exposure and wetting constantly predisposed the troops to relapses, as most of them had been previously infected.

It was consequently decided that: (i) Mosquito nets should be used at night

YEAR 1931. INDIAN OTHER RANKS. MALARIA.

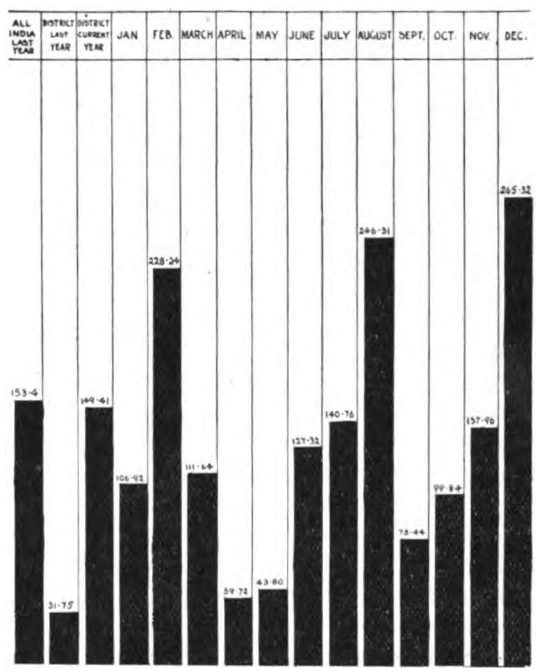


CHART 2.—Showing equivalent annual ratio per 1,000.

wherever possible. (ii) Prophylactic quinine should be given. (iii) Repellents should be available for use by all troops. This was in addition to the other orders such as those forbidding the wearing of shorts after sunset, etc.

Every man possesses a mosquito net, and in Burma these are used in all cantonments all the year round; the men are therefore accustomed to them and like them for the protection from irritating bites. The nets are of good quality and are meant for use with a bedstead or charpoy. A special bivouac type was promised from India, but did not arrive in my time. All the huts occupied and all buildings taken over were wired by the R.E. for the suspension of these nets. Difficulties were experienced; where no bedsteads or charpoys were available and the men lay on the floor it was reported that the nets could not be used; however, a lengthening of the

hanging tapes soon overcame this. Even in the small Indian 160 lb. tent nets can be used for every man if they are trained to it; we had carried out such training during the previous cold weather and proved to all ranks that it could be done. Nets were therefore used wherever possible, and it was only parties doing night operations that could not be so protected. Some of the immunity from malaria must have been due to their use.

Prophylaxis.—No one could gauge how long this rebellion was going to last; it might be a few months; it might be a year or two. In the early stages the troops were all too few to deal with the situation and at this stage it was doubtful if we could succeed in protecting the men by nets at night. Mosquito-proof quarters were out of the question and larger measures of dealing with the mosquitoes in the posts were impossible. Quinine prophylaxis therefore seemed indicated. European officials whose work lies in the jungle of Burma had no doubt about its value. The question of whether malaria would merely be masked and relapse cases more frequent was regarded as of little immediate importance. It was necessary to maintain men at duty; consequently quinine was given under strict medical supervision, in 10 gr. doses, to every man in a post outside normal cantonments.

Up till October, 1931, quinine prophylaxis alone was employed and the incidence of malaria per 1,000 was only a decimal point in excess of the figures for Burma in the previous year, when the troops were in normal cantonments. At this stage the work of Colonel James on the use of plasmoquine as a prophylactic was receiving publicity and my successor decided that it was worth a trial. My successor, Colonel Hanafin, points out that the figures for Thayetmyo are to some extent fallacious, as in many cases the diagnosis was only clinical and there is a strong tendency in these circumstances to regard any short pyrexia as malaria. The change from quinine to plasmoquine also complicated the figures, but it was found that amongst equal bodies of men, half taking quinine and half plasmoquine, the result was slightly but distinctly in favour of quinine.

Later, a small reconnaissance party made a tour of a very malarious district known as the Pegu Yomas—and at a very malarious time of the year—with the A.D.M.S.; a careful trial of the two methods was made, and the result was strongly in favour of plasmoquine.

Shortly afterwards an extensive sweeping operation of this area was carried out, and acting on the experience gained from the reconnaissance, plasmoquine was used instead of quinine. The A.D.M.S. pointed out to the General Staff that even with prophylaxis a high incidence of malaria was likely, and actually forecasted the daily numbers of sick to be expected from it. The General Staff decided that military necessity overcame the medical situation and the loss of man-power would have to be faced. The estimate of casualties made by the A.D.M.S. proved to be almost mathematically correct. This drive was successful and ended the rebellion, as most of the leaders and their followers were killed or captured.

The D.M.S., in his report of the health of the Army in India for 1931, refers to malaria prophylaxis in Burma as follows:—

"In addition both quinine and plasmoquine were used as prophylactics on alternate bodies of troops, even though it was realized that there would probably be an increase in relapse malaria in the following year. The results were satisfactory in that the Force did not suffer

to any appreciable extent, but the anticipated increase in relapse cases has occurred, at least among Indian troops."

The relapse figures for British troops for March, April and May, 1932, were below the figures for all India. For Indian troops who had served in Burma, relapse cases were 17·6 compared with 2·9 per 1,000 for all India in March, 1932, 16·5 compared with 4·4 for all India for April, and 6·7 compared with 6·9 for May. It appears to me that if treatment with quinine or plasmoquine had been continued for two months after the troops left the malarious area, this increase might have been obviated.

The total figures for malaria in Burma for the year of the rebellion showed an increase over 1930 from 40·19 per 1,000 to 66·34 per 1,000 for British troops. For Indian troops the incidence rose from 31·75 to 149·41 per 1,000.

Use of repellents.—For sentries, and during the frequent night operations in the jungle, bamber oil was used. The men have great faith in this, and like it if only for the freedom which it confers from the irritation of insect bites. At first small parties carried bamber oil in bulk in bottles or tins for general use, but an individual supply was judged to be necessary, and the 12th Infantry Brigade indented for 4,000 4-oz. bottles for the purpose. Though these bottles could have been provided by the medical store depôt at Rangoon, it was felt that constant replacements would be necessary, as men would be inclined to throw them away when empty; metal rifle-oil bottles were therefore obtained from Arsenal and 200 were issued to each regiment to be used by sentries and parties on night raids.

The rebels, who were tattooed to confer invulnerability, were under the impression that our men used bamber oil as a charm.

Diagnosis of malaria.—It may be contended that diagnosis may have often been fallacious in the absence of laboratory proof. This had been anticipated, for when the medical necessities had been represented to Simla, additional microscopes had been asked for and supplied, and the more important detention hospitals had clinical side rooms, the necessary stains, etc., being supplied from the district laboratory. All assistant surgeons and sub-assistant surgeons are trained in the identification of the malarial parasite. Nevertheless the diagnosis must of necessity often have been clinical, but, in spite of the tendency of sub-assistant surgeons to regard any short pyrexia as malaria, I do not think that the figures are seriously wrong.

In cantonments in peace the tendency is to regard cases of malaria as relapses in order to safeguard the good name of the cantonment. During active field operations, however, the tendency was to regard every case as a fresh infection. It was probably thus that some exaggeration of the incidence of malaria occurred, for relapses must have been frequent in a body of men, most of whom had previously suffered from the disease.

Venereal disease.—Venereal disease has always been a trouble to medical authorities in Burma, and in peace times it provides the highest ratio per 1,000 of any district under the Indian Government.

Rangoon is a large and cosmopolitan seaport, where the disease abounds, but even in towns up country, such as Mandalay and Maymyo, it is very prevalent. Most of the native population receive no treatment—or, at the very best, inefficient treatment—for the disease.

The absence of caste amongst the Burmans and the freedom which their women

enjoy assists in the propagation of the disease. The British troops suffer most, but while the true Indian regiments have little or none, the low caste followers always provide many cases and the local Burma Rifles suffer considerably from venereal disease: this appears to exist in remote villages, as many cases occur amongst the furlough men.

The methods adopted to safeguard the troops did not differ materially from those in use elsewhere. Early treatment rooms were provided in all barracks and established at all posts where the disease was likely to occur. British troops were

YEAR 1931. BRITISH OTHER RANKS. VENEREAL DISEASE.

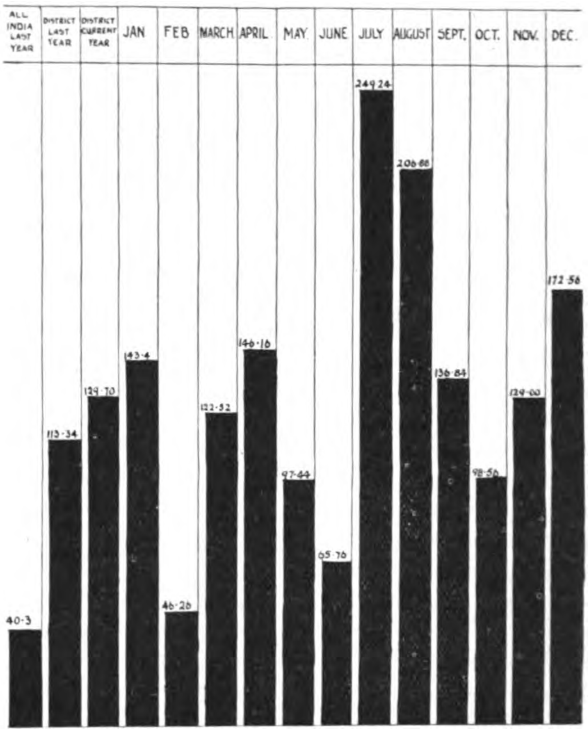


CHART 3.—Showing equivalent annual ratio per 1,000.

provided with prophylactic packets, but these were not at first sanctioned for Indian troops. Special representations on this point were made to headquarters, and at a later date these packets were sanctioned for the Burma Rifles, who have no caste prejudices against their use. The local police authorities assist by closing houses and deporting those who spread infection. Where brothels abound we found no value in putting houses or streets out of bounds, for the inhabitants simply migrate and roadside infection is common.

Unfortunately, the incidence of venereal disease amongst British troops threatened to assume serious proportions when the brigade from India arrived. The British regiment which accompanied that brigade had only left Burma the previous year

and had been stationed in a part of India where access to women was difficult. They unfortunately knew their way about Burma and the detachments in Mandalay and Meiktila suffered heavily. Had it not been for this increase in venereal disease the sick statistics for British troops during the rebellion would have been better than for the preceding years.

Extra accommodation for such cases had to be provided at the British Military Hospital, Maymyo, and the increase amongst Indian troops necessitated the transfer of cases from Mingaladon to Maymyo to provide accommodation.

YEAR 1931. INDIAN OTHER RANKS. VENEREAL DISEASE.

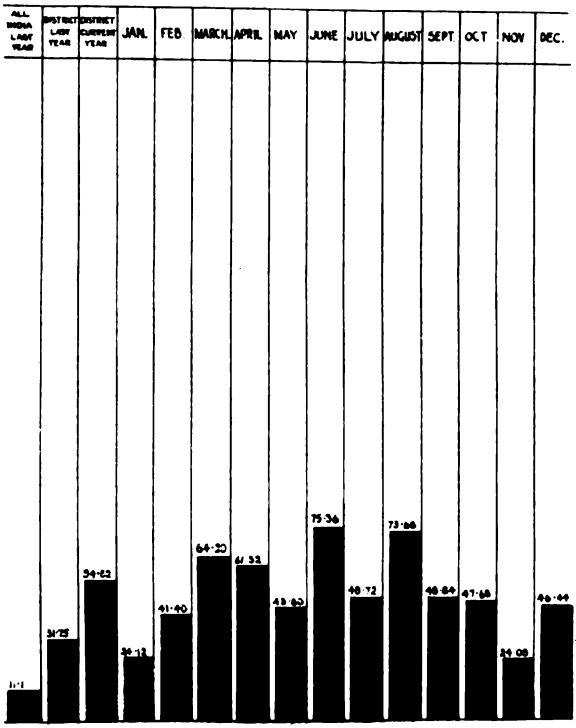


CHART 4.—Showing equivalent annual ratio per 1,000.

Heat stroke.—The medical history of previous campaigns stresses the number of officers and men lost from heat stroke. My experience of the troops for the preceding three years in Burma had been that heat stroke rarely, if ever, occurred, and it required some self-discipline to maintain the heat stroke centres as laid down by Simla. The conditions encountered during active operations in the jungle during the monsoon were different from life in cantonments, consequently heat stroke precautions had to be formulated—the issue of ice to every post was recommended to the G.O.C., and the A.D.S. and T. succeeded in supplying ice to every post in the field. This was a really fine achievement, for in some cases the ice travelled by train, boat and pack for hundreds of miles, and the wastage was necessarily

enormous. A few cases of mild heat exhaustion occurred, but no deaths therefrom. The ice was, however, much appreciated by all ranks. The excellent huts provided and the suitable army type of the barracks occupied in old cantonments were factors in the immunity of the men from the effects of heat.

It may be said that the troops that were principally employed in the operations, being Indian, were not so liable to suffer from heat; but the Burma Rifles are recruited almost entirely from hill tribes of Chins and Kachins who do not appreciate the hot weather in the plains of Burma, yet they were immune from heat stroke. In all huts and buildings occupied by British troops punkahs were installed, and in Toungoo we had electric fans.

Prophylactic inoculations.—The protection of the troops from the enteric group of fevers by inoculation with T.A.B. at the outbreak of hostilities was good, amounting to about 99 per cent. The breaking up of the troops into small scattered bodies soon made it difficult to maintain this high figure of protection, and orders had to be issued to ensure the reinoculation of men as it became due. The difficulty was increased by the fact that some units arrived from India without medical history sheets and some time was lost in procuring them. The results were, however, quite satisfactory and no difficulty was experienced later.

Plague and cholera.—As both these diseases are ever present in Burma, plague and cholera vaccines were kept ready at outposts.

A certain restraint has always to be maintained to prevent young medical officers from rushing at plague inoculation on hearing of a case in the neighbourhood. In peace time a case hardly ever occurs in barracks, and we inoculate all troops only if a case occurs amongst the men or plague-infected rats are found in barracks. If this attitude was not adopted inoculation for this disease would be continuous. In one instance, in the Thayetmyo area, a company of troops had to be inoculated, as plague-infected rats were found in barracks, and in another when a case of plague occurred in a baker at Meiktila.

Tetanus.—This is fairly prevalent in Burma, and every post was provided with antitetanic serum for those wounded, whether in action or by accident, and no case occurred.

Rabies.—This is unfortunately very common in Burma. There is a Pasteur Institute in Rangoon where treatment can be given. Just before the rebellion we had obtained sanction from the Government of India to establish a branch institute in the British Military Hospital, Maymyo; hence there was no difficulty in providing treatment for troops either in lower or upper Burma within twenty-four hours of being bitten. No case occurred.

Rations.—A potent factor in maintaining the health of the troops was good and generous rations. Although conditions were not recognized as active service, Simla sanctioned the issue of rations on the field service scale to all Indian troops in the field posts and of rations on the winter scale to certain troops, such as pioneers doing strenuous work in the wet on the roads.

Special precautions have to be taken in Burma to prevent beriberi amongst troops who are exclusive rice eaters. Some years before, Major G. Wilson, R.A.M.C., discovered that this disease, which was very prevalent, could be prevented by issuing a half ration of rice and half of atta (the coarse Indian flour of the country). At first the rice-eating troops, who did not know how to make

chupattis, did not like it, but they soon got accustomed to it and the disease ceased. That an exclusively rice diet could cause the disease was confirmed the previous year when a new unit arrived from India, and, unaware of local orders, did not draw the atta ration. Several cases of beriberi soon appeared in hospital at Mandalay, and the previous experience enabled us to detect the cause and remedy it at once, with a result that no more cases occurred. This modification of the ration was therefore insisted on from the first with the new troops, and no further cases of beriberi occurred.

The regulation regarding the issue of rum had been modified, and it is not allowed without the sanction of the Government of India. Extra tea and sugar can be issued on medical recommendation in inclement weather. Officers Commanding objected to the extra tea, and pointed out that something was wanted which could be issued to men immediately they returned tired and soaked after a march through jungle and swamp. Sanction was, therefore, obtained, and with certain safeguards rum was to be issued on the recommendation of the local medical staff. This was much appreciated, and I am satisfied that it did nothing but good.

Disinfection.—With the very numerous scattered small posts this was a real difficulty, but the field service dress of the Indian soldier in the hot weather is not bulky and could be boiled.

All our fixed cantonments had steam disinfectors: at Mingaladon a fine Alliott and Manlove disinfector, and at Mandalay and Maymyo portable Thresh disinfectors. No. 14 Sanitary Section brought with them a portable Thresh which was retained for use at Sale Barracks, Rangoon. When the troops first moved to Thayetmyo a Lelean's sack used for demonstration at our sanitary training centre was sent, but it was reported not to work well. The boiler was a local product and not very efficient. However, when a plague scare occurred in that area, a good steam disinfector was placed at our disposal by the local jail. Disinfestation of the troops was never necessary. Water was abundant if not very pure, and the troops washed frequently. There was no trench or dug-out work, and woollen underclothing was not used.

Snake bite.—Burma is infested with deadly snakes, and provision had to be made for immediate treatment of snake-bite. Antivenine was available at every post, and with every moving body of troops. Ice boxes were available for the storage of this and other sera and vaccines.

Poisoned weapons.—Information was received by the Intelligence Department that poisoned weapons might be used by the rebels. In the Andaman Islands the almost extinct race of Jarrowers still use poisoned arrows, and they were also stated to be used by the inhabitants of the unadministered territory known as "the triangle" in northern Burma. Authorities were consulted and it emerged that the substance used was the resin of a tree called hymaseik (*Anticaris toxicaria*), and that it might be smeared on bamboo stakes, palisades, or on arrows. Specimens were obtained and experiments were carried out in the Brigade laboratory at Mingaladon. These showed that it is a very potent poison when injected into wounds. No cases of wounds by any poisoned weapons were met with during the rebellion.

Foot trouble.—Sore feet on the march were very rare and the infrequency was attributed by one senior medical officer to the fact that on night marches through the jungle, which often amounted to twenty miles in a night, the men wore their rubber gymnasium shoes. Whatever they wore was bound to be wet through almost at once, and the thin gymnasium shoes were probably more comfortable than boots.

Gas gangrene.—This was seen in several cases. One officer lost his leg from it and his life was apparently saved by *Welchii* serum. The accepted principle of early primary or secondary suture proved its value. Every officer and man was in

YEAR 1931. BRITISH OTHER RANKS. ADMISSIONS, ALL CASES.

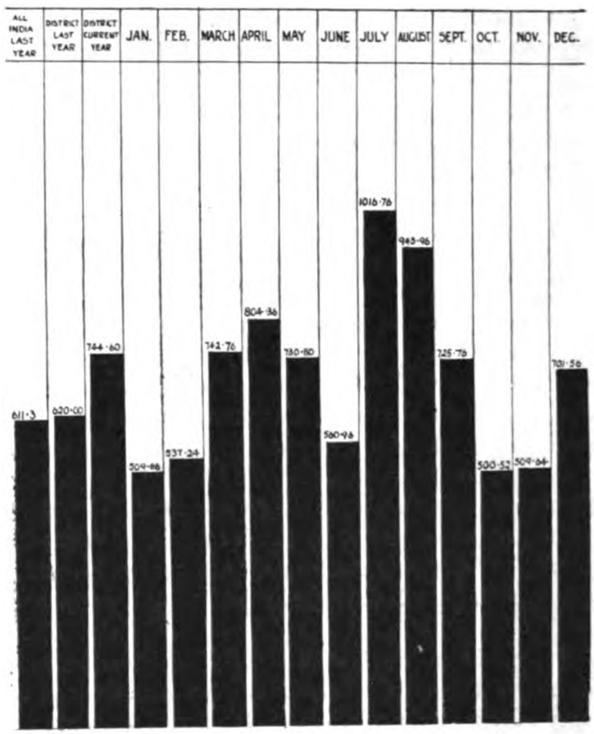


CHART 5.—Showing equivalent annual ratio per 1,000.

possession of a first field dressing of the old type. The Director of Medical Services in India increased the surgical facilities by bringing the surgical equipment at Mingaladon and Mandalay up to the requirements of a first-class operating centre.

The surgical equipment of the field units from India, though they fell far short of what is now provided in the field equipment of the Home Army, was, nevertheless, a great improvement upon that of a few years ago. A very good operating room was established by No. 3 Indian General Hospital at Thayetmyo.

The widespread posts necessitated the issue of large numbers of medical companions and surgical haversacks. The field ambulance equipment was heavily drawn on at first in this respect until the medical store depot at Rangoon obtained additional supplies.

Boxes containing a complete medical and surgical equipment were held ready at hospitals for immediate issue when new posts were occupied, and there was never any shortage of drugs or dressings. Stretchers would have been insufficient to deal with heavy battle casualties, but in the jungle blankets stretchers could always be improvised with bamboo poles.

Laboratory equipment.—Additional microscopes were demanded and supplied from India so that main posts could verify the diagnosis of malaria. Stains, etc., were supplied from our district laboratory.

YEAR 1931. INDIAN OTHER RANKS. ADMISSIONS, ALL CASES.

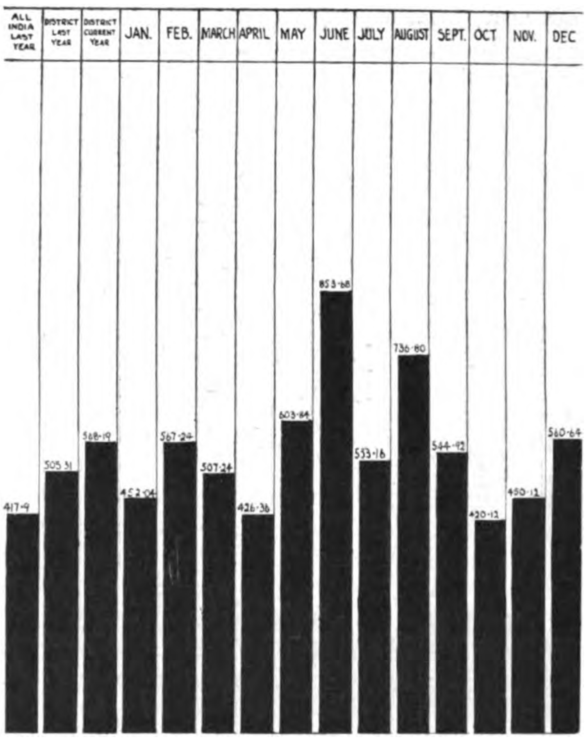


CHART 6.—Showing equivalent annual ratio per 1,000.

In addition to special sanitary instructions issued to all medical personnel, the G.O.C. issued a special order to all officers commanding posts, which drew special attention to their responsibility for the health of the troops, and it was only the very friendly co-operation between the fighting troops and the medical service that rendered possible any success that attended the efforts to maintain the troops efficient throughout a very difficult period.

No good results could, however, have been obtained but for the splendid way the D.M.S. at Simla responded to every request, in spite of the fact that the situation in India at that time was strained, and personnel and equipment could be spared only with great difficulty.

Much valuable help was also given in sanitary and pathology matters by the Assistant Director of Hygiene and Pathology at Army Headquarters.

This account may be of interest in showing that the health of troops in a tropical country can be maintained at such a level as to permit of successful military operations even in the unhealthy season.

In the report on the health of the Indian Army for 1931 the D.M.S. for India in referring to the health of Burma, says:

"No particular group of diseases were involved and it is considered that the health of the troops was satisfactorily maintained under very adverse conditions."

YEAR 1931. BRITISH OTHER RANKS. TOTAL INEFFICIENTS.

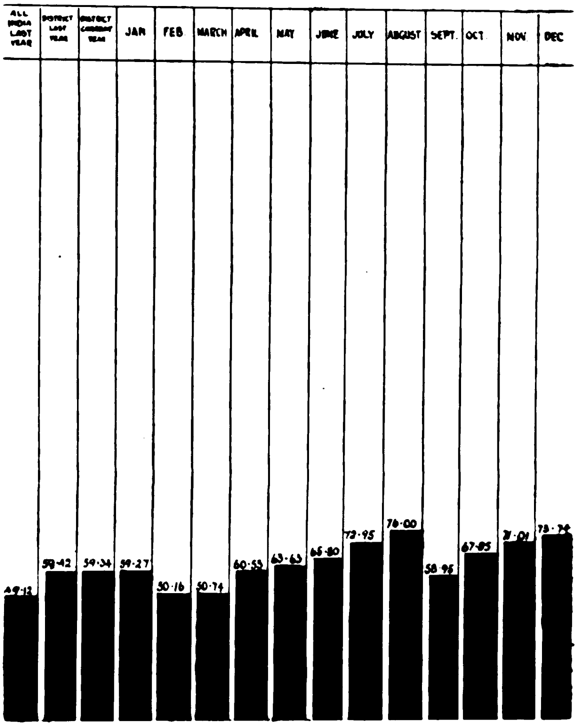


CHART 7.—Showing equivalent annual ratio per 1,000.

This is illustrated by the charts which show the total admissions to hospital for all causes for British and Indian troops contrasted with the admissions for all India and Burma for the previous year.

The chart showing total inefficients is a combination of the figures for men in hospital and in barrack treatment.

The average constantly sick rate for Indian other ranks in the Thayetmyo area where the most active operations were in progress in August was (in round figures) 25 per 1,000. In September, 27; in October, 33; in November, 25; and in December, 24 per 1,000.

During the same months the numbers on barrack treatment, i.e., attending for treatment but not in hospital, were (in round figures) August, 27; September, 26; October, 31; November, 32; December, 24 per 1,000.

YEAR 1931. INDIAN OTHER RANKS. TOTAL INEFFICIENTS.

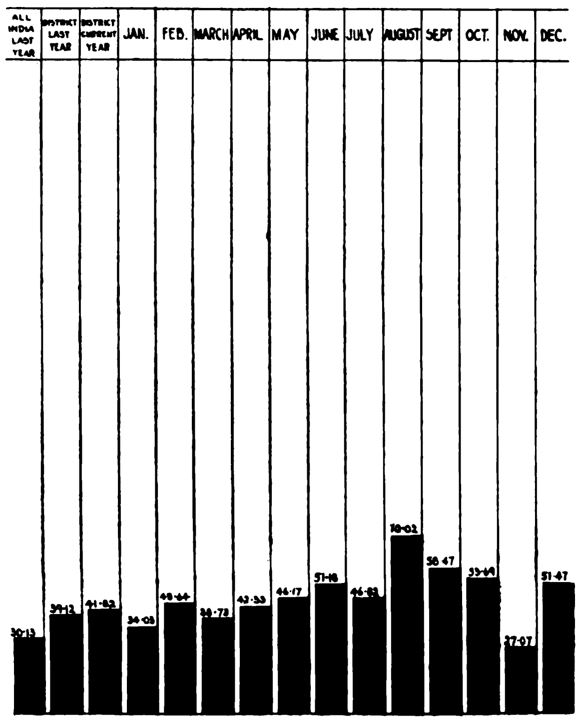


CHART 8.—Showing equivalent annual ratio per 1,000.

For British troops in this area the figures were even better. The average strength was small, but the constantly sick rate in hospital was under 2 per 1,000 for the five months and the constantly sick attending hospital rate was under 6 per 1,000. If venereal disease could have been eliminated amongst British troops the figures would be almost nil.

PLASMOQUINE AS A MALARIA PROPHYLACTIC.

By Colonel P. J. HANAFIN, D.S.O.,

Those who have read of the tests made by Colonel S. P. James, F.R.S. (Member of the Malaria Commission of the League of Nations) and his collaborators on the prophylactic action of plasmoquine and described in the *Lancet* of June 6 and August 15, 1931, may be interested in the tests on the same subject described in this paper.

On reading Colonel James's article it occurred to me that if the results of his experiments were maintained, plasmoquine would be a most valuable prophylactic against malaria in the military operations taking place at that time in the forests and swamps of Burma where the incidence of this disease was extremely high.

The rebellion which had started in December, 1930, had spread to the whole of lower Burma, where the dense forests and jungle offered great facilities for guerilla warfare. In the summer of 1931 two Brigades of British and Indian troops were employed in endeavouring to suppress the rebellion, but so far they had not penetrated the most malarious areas.

On September 30, 1931, I had received orders to proceed to Burma and assume the duties of A.D.M.S. A suggestion was made to A.H.Q. that plasmoquine, if available, should be placed at my disposal. I was given permission to purchase what was required, but owing to the difficulties of obtaining the drug in the quantities necessary, we were not able to start the tests before the end of October. By this time, the greater number of the rebels had found the cultivated parts of lower Burma too hot to hold them and had retired into the almost impenetrable and highly malarious forests of the Pegu Yomas. This region had a most unenviable reputation for malaria and the high mortality from this disease had almost depopulated the area. Still, if the rebellion was to be crushed, operations on a considerable scale involving at least two to three thousand troops in these forests would be necessary. A reconnaissance in force through the relatively unknown tract was decided on as a preliminary measure and one platoon of the 2/15 Punjab Regiment was selected to carry this out. This offered a magnificent opportunity for carrying out an experiment as to the value of plasmoquine, and I determined to accompany the platoon so as to supervise the experiment and also to gain some information as to the nature of the ground over which operations were to take place.

This test partook more or less of the nature of a laboratory experiment in the completeness of our knowledge of all the relative factors and the accuracy with which it was carried out. It was a marked contrast to the tests on a very much bigger scale carried out later, when the subjects were

scattered over as many as eighty separate jungle areas each under the observation of only a sub-assistant surgeon and often far from reach of laboratory facilities. In this test five officers and thirty-five men, whose previous medical history was known, left a non-malarious station, lived for three nights in a highly malarious area, returned to a non-malarious station and were under close and continuous medical supervision for several weeks. All cases of fever were examined by a very competent bacteriologist and in every case diagnosed the malarial parasite was found and identified.

The men of the platoon were divided into two equal sections, each of which contained four men who had previously suffered from malaria.

Fig. 1.—Our baggage train. No. 1 experiment.

One half platoon was given 10 grains quinine every day half an hour before sunset and the other half received 0·02 gramme plasmoquine at the same time. In addition five officers were placed on plasmoquine and one sub-assistant surgeon on quinine (which he only took on the first night as he said it made him sick).

The results of the experiment were most satisfactory and decidedly in favour of plasmoquine.

Five cases of fresh malaria occurred among the men taking quinine as against one or possibly two of those taking plasmoquine. The second case on the plasmoquine side was a sepoy who had had M.T. malaria four months earlier and developed M.T. malaria eighteen or nineteen days after exposure. He can fairly be ruled out as not being a fresh case.

One of the cases taking quinine had malaria three years previously, but on that occasion the infecting organism was B.T., whereas his present infection is M.T. He must therefore be included. It probably would not be fair to include the officers, as they as a class take more precautions than the men.

The incidence of malaria amongst those taking quinine was therefore 27·7 per cent, and amongst those taking plasmoquine 5·88 per cent, or, if officers be included, 4·55 per cent.

The march was carried out under most strenuous conditions when there was no possibility of adopting any other anti-malaria precautions except

FIG. 2.—On the march. No. 1 experiment.

application of bamber oil. The forest and jungle were so thick that even mule pack transport was impossible and elephants had to be employed to transport the limited amount of baggage permitted.

The party left Mingaladon on October 30 and motored to Paunggyi where they slept the night. On the 31st the force marched up the valley of the Ngamoyeik Chaung to the Forest Bungalow at Kyauksayitkon, a distance of about twelve miles. The night of the 31st was spent at this bungalow, the officers sleeping in the rooms overhead and the men on the open ground underneath. The bungalow, like most of these in Burma, is built on high stilts. Next day the march was resumed through dense forest to Gyobyu. The first four miles of this was along the bed of a stream in places waist high. This was followed by several miles of mountainous

forest path and again the bed of a river for one mile. The remainder of the journey was by difficult forest paths. The distance covered this day was about nineteen miles. The night was spent at the Forest Rest House at Gyobyu under similar conditions to those of the 31st, and the march was continued next day to Taikky where the party entrained for Mingaladon, arriving at the latter station before sunset. The only clothing carried by the men was shorts, short-sleeved shirts, helmets and canvas shoes. At night one blanket per man was issued. The arms and legs were at most times completely exposed to mosquitoes.

The rains had stopped about eight days before this march began and

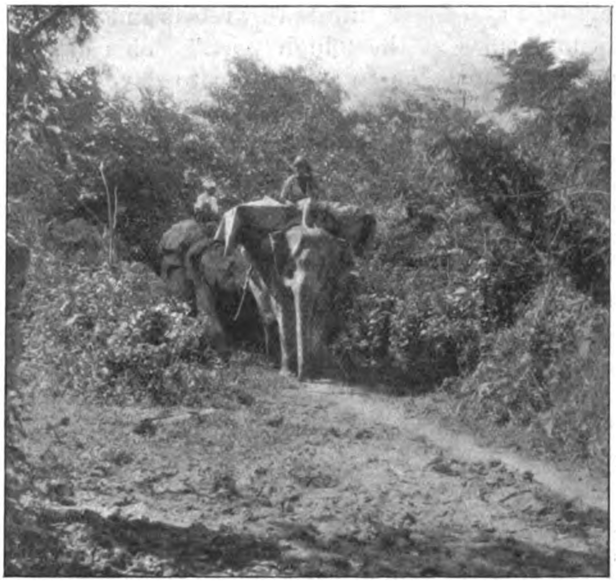


FIG. 3.—Typical jungle path.

the most malarious season, according to local repute, is the two months following the rains.

The ground at Paunggyi during the first day's march was relatively open and interspersed with numerous pools and swamps. The rest house at Kyauksayitkon was on comparatively high ground, surrounded by dense forest with numerous streams running through it. The rest house at Gyobyu was also on high ground surrounded by forest, but with relatively little undergrowth. Mosquitoes at the first two halts were not so numerous as at Rangoon, but several species of anopheles were noticed. Mosquitoes were more numerous at Gyobyu. A spleen count was made at several villages and varied from fifty-eight per cent at Paunggyi to eighty-five per cent at Kyauksayitkon. Some difficulty was experienced in carrying this

out, as the local population was very disaffected and in most cases fled to the jungle on our approach.

From subsequent experience it was found that Kyauksayitkon was intensely malarious whilst there was very little of this disease at Gyobyu. It is therefore probable that the greater number of cases which resulted from this march were infected on the night of the 31st. Incidentally this gives interesting information as to the incubation period of malaria which in these cases was from nine to seventeen days.

The plasmoquine and quinine were administered after the evening meal about half an hour before sunset, and in no case was there any complaint of ill-effects from the former. Excitement may have had something to do with the absence of toxic symptoms, as the greater part of the march was through dense jungle and forest infested by rebels and was carried out with fixed bayonets and rifles at the "high port." This did not give much opportunity for symptoms due to suggestion to develop.

The administration of plasmoquine and quinine was continued for three days after return to barracks and then stopped. Better results as regards admission to hospital would probably have been obtained by continuing the administration for a longer period but, in view of Colonel James's opinion that plasmoquine killed the parasite in the sporozoite stage, I did not wish merely to mask the appearance of symptoms in those already infected.

The results of this march appeared to be fairly conclusive in favour of plasmoquine and suggested, if anything, that the dosage employed was too small, and that with correct dosage an absolute preventive of the disease had been found. Further support as regards the reliability of the figures already obtained was provided in December when a large number of troops was engaged in the area in which the reconnaissance march had been carried out. By a simple sum in proportion it was found that if the same rate of incidence held, 600 cases would occur if all the troops which it was proposed to use were on quinine, and 120 cases if on plasmoquine. The case was represented to "G" Staff, who considered that the military necessity justified the risk. All troops engaged were placed on plasmoquine and 128 cases of fresh malaria (within seven per cent of the estimated figure) were actually admitted from the area under consideration.

So far the results were quite up to expectations and our hopes that we had at last found a reliable prophylactic were high. Admittedly the figures in the first experiment were too small to give reliable results, but the figures appeared to be confirmed by those just mentioned.

The results of the second experiment were not so favourable. As soon as sufficient plasmoquine was available in Burma it was determined to place all troops in malarious areas on either quinine or plasmoquine. Elaborate precautions were taken to assure that they should be divided into two equal and comparable groups. As the majority of the posts in the rebel area were occupied by a platoon or more, the platoon was taken as the unit to work on. Each platoon was divided into two equal halves as

in the experiment just described, one half being placed on plasmoquine, 0·02 gramme, and the other on quinine, 10 grains. Altogether 5,147 men were dealt with over a period of three months. Of these the average number on plasmoquine was 2,634 (of whom 464 had a history of malaria) and 2,482 on quinine (of whom 448 had a history of malaria). The numbers were originally more evenly divided, but casualties of various sorts upset this equality. Charts similar to those used in the original experiment were prepared for each platoon and the administration of the drugs was entrusted to the platoon officer (a subahdar), who was found to be most reliable for carrying out a routine procedure of this sort. All charts were returned to District Headquarters with lists of all cases of malarial attacks whether fresh or relapse.

Fewer fresh cases occurred amongst the plasmoquine groups, but the number of relapse cases was much higher in these groups than in the quinine groups. Again, taking fresh cases only, the advantage in favour of plasmoquine was much higher in the first month, 27 to 10, and this advantage was gradually reduced until in January it was only 16 to 13. The statistics for February, although too small to be of much value, show a slight balance in favour of quinine. In this month as the malaria season was almost finished, the administration of prophylactics had been discontinued in several stations.

The accuracy of the statistics for November, December and January cannot be considered as in any way comparable to those for the reconnaissance march described earlier, as the men concerned in the larger experiment were scattered in small parties all over the jungle and forests of lower Burma, sometimes six days' march from the nearest hospital, were constantly on the move and often not under medical observation. In the majority of cases microscopic examination of the blood was not possible and the diagnosis was made by a sub-assistant surgeon from clinical symptoms only. Any errors made in compiling statistics at these posts took a long time to rectify, as owing to the ubiquitous rebels communication was spasmodic and it often took fourteen days or more to get a reply from the sub-assistant surgeon responsible. In addition to this, the subjects of the tests were in a malarious area before the commencement of the experiment and owing to the indefinite incubation period of malaria it was difficult to know whether the infection had taken place before or after the commencement of the experiment. Quinine had been used as a prophylactic in a large number of cases before the comparative test began.

With all these possibilities of error, it took a very long time to analyse the figures available and I recognize that I may have been prejudiced in favour of plasmoquine, though I have done my best to be impartial.

Under the heading of fresh cases, I placed only those in which there was no previous history of malaria and in which the diagnosis, whether microscopic or clinical, was definite. Under the heading of fresh cases I received such diagnoses as "malarial cachexia" and "malarial

anæmia." These were rejected. The majority of fresh cases occurred when the troops followed the rebels into the forests of the Yomas in December. As previously stated, all the troops in these highly malarious regions were placed on plasmoquine and are therefore not included in the statistics. I admit that a magnificent opportunity for proving or disproving the case for plasmoquine was missed by doing this, as the 2/15 Punjab Regiment from non-malarious Mingaladon was employed in these operations and we could have carried out an experiment equal in accuracy to the first one, but with very much larger numbers, had we placed half the regiment on plasmoquine and half on quinine during these operations.

As I considered my first duty was preservation of the health of the troops and not the carrying out of any experiment, however valuable to humanity, I refrained from this. On the basis of the figures of the first experiment I calculated that we would have 360 cases of malaria if the administration of quinine and plasmoquine was continued as before, whereas only 120 would be expected if plasmoquine was used in every case. As stated previously, plasmoquine only was used and 128 cases were admitted from this particular area.

In considering the figures of the larger experiment we must remember that in this case we are dealing with more than prophylaxis. Cases which in spite of the prophylactics used become infected are then subjected to the therapeutic action of the drugs used. If we accept the statement made in the articles in the *Lancet* already referred to, that plasmoquine is relatively ineffective against the fever-producing asexual stage of the plasmodium, it follows that any case of malaria occurring in the plasmoquine group will run a more or less unchecked course, whereas those occurring in the quinine group may be so modified by the action of this drug on the fever-producing stage that they may easily escape observation. It is a well-known fact that amongst the Assam planters who usually take 10 grains of quinine a day as a prophylactic, the first attack of malaria frequently occurs when on leave in England when no quinine is being taken.

This may have had a prejudicial effect on the figures given for plasmoquine and efforts are now being made to follow up the after-history of the subjects of the test who in many cases have returned to India. The therapeutic action of quinine would also account for the much lower incidence of relapses amongst those in the quinine group.

The therapeutic action of quinine I consider to have been the most important factor in causing the marked difference in results between the two experiments as the other errors incidental to the campaign would, with the large number under consideration, average out as much the same on each side.

The second experiment even as it stands is, I consider, decidedly in favour of plasmoquine even on the dose 0·02 gramme given. This dose is definitely too small and in any further experiments which we hope to

make in the coming malaria season 0·03 gramme is to be used. A dose of 0·02 gramme was decided on after consultation with Army Headquarters, in view of the strenuous exertions the troops were called on to undergo in the campaign and of the numerous reports of toxic effects received from hospitals where the drug had been used for treatment.

I was, however, convinced that the toxic symptoms were very largely due to suggestion and every effort was made to avoid this in the present case. As a result only three cases of colic and no other symptoms were reported out of 2,634 men and after the administration of 23,760 doses of the drug. There was no evidence whatever to prove that the plasmoquine was the cause of the colic in these cases.

When malaria cases commenced to come in in large numbers from the Yoma in December the dose of plasmoquine was raised to 0·03 gramme with no ill-effects. As the troops were withdrawn from this area eight days after the dose was raised, no conclusions could be come to as to the prophylactic effect of this dose.

From a general view of the results so far obtained I have come to the conclusion that :—

(1) Plasmoquine gives great promise as a prophylactic and when the proper dosage has been ascertained very excellent results should be obtained.

(2) A dose of 0·02 gramme is definitely too small. The correct dose will probably be found to be 0·03 or 0·04 gramme.

(3) Toxic effects even in men undergoing most strenuous exertion are far less than hitherto expected. A dose of 0·02 gramme is definitely non-toxic even when continued over long periods ; 0·03 gramme would appear to be equally harmless.

(4) Better results, as judged by hospital admissions, would probably be obtained by a combination of quinine and plasmoquine. No definite information could however be extracted from the results of such a combination and as it is possible that by further research on the present lines a reliable prophylactic may be discovered, it is most undesirable to confuse the issue by such a combination. The discovery of such a prophylactic would be of incalculable value to the Army and to humanity in general.

In conclusion I must mention that the real spade work in this investigation was not done by me but by a number of very able officers of the I.M.S. and R.A.M.C., notably by Lieutenant-Colonel Tabuteau, Major O'Riordan, Major Joshi, Captain Day and Lieutenant HoMen Sen.

Since writing this article I have ascertained that the majority of cases reported by Colonel James as free from malaria six weeks after infection have since developed the disease, some as late as six months after exposure. This late development of malaria may be the explanation of the

increased number of fresh cases in the plasmoquine group in the second, third and fourth months of the second experiment described above.

[It has been a common experience of those who have used quinine prophylactically to find that, while the patients remained free from any overt symptoms when under the influence of the drug, they at a later date developed the disease under circumstances which left no doubt that they had acquired the infection during the period when they were taking prophylactic quinine.

These relapses (for so they must be regarded) occur chiefly in the spring which is, *par excellence*, the relapse season of uncured benign tertian malaria.

As the cases in the above experiment which received prophylactic plasmoquine have not been followed up over this relapse season, the deductions drawn and the figures quoted must be regarded with a certain amount of caution.—Note from D.M.S., India.]

A REPORT ON SIX HUNDRED CASES OF MALARIA TREATED WITH PLASMOQUINE AND QUININE.

By Major H. B. F. DIXON, M.C.,
Royal Army Medical Corps.

A survey of the existing literature on plasmoquine, which was first prepared by Schulemann and his colleagues in 1924 and offered to the medical profession in 1926, is now well-nigh impossible.

The publications on the subject had reached on October 1, 1930, a total of 415, and a search through the Index Medicus up to date shows that plasmoquine appears under every aspect of the malaria problem—therapeutics, prevention, prophylaxis, blackwater fever, avian malaria, malarial treatment of G.P.I., etc.—and that almost every article on malaria that one reads has some reference to plasmoquine.

Apart from the importance of its discovery as the first synthetic preparation which was found to have a definite action in malaria, the fact that it had a specific action on certain stages in the development of the parasite in man had far reaching effects. Since then a new form of malaria therapy has arisen—the treatment of malaria by attacking the various phases of the life cycle in man, a drug for the sporozoites, a drug for the schizonts, a drug for the sexual forms. In the past, one gave quinine in as large doses as possible, as quickly as possible and for as long as possible. This resulted in a relapse rate of 50 per cent.

The present position as regards plasmoquine, as gathered from a survey of the recent literature, and especially the "Discussion on Synthetic Anti-malarial Drugs" at the Royal Society of Tropical Medicine and Hygiene (1932), is as follows:—

Plasmoquine has a definite action on the sporozoites of *Plasmodium falciparum*, and in non-toxic doses it can be used as a prophylactic.

In *P. vivax* infections it has also a definite action on the sporozoites, and in large doses will prevent infection in 50 per cent of the cases; in the remainder, infection does not develop until six months or more.

In *P. falciparum* infections it has no effect on the schizonts, but it is extremely effective against the sexual forms.

In *P. vivax* infections it has some effect on the schizonts, not as great as quinine, but it is very effectual against the sexual forms.

It is extremely effective in treating *P. malariæ* infections; no relapses are recorded.

In combination with quinine it is most effective in preventing relapses in *P. vivax* infections.

Its effect in preventing relapses is the subject of this paper. The general

consensus of opinion among tropical workers is that the treatment of benign tertian infections with a combination of plasmoquine and quinine has reduced the relapsed rate to between 5 and 7 per cent. This opinion, however, is not so enthusiastically shared by laboratory workers and clinicians in non-tropical countries. Both James and Swellengrebel (1932) at the discussion mentioned above, gave results at variance with those of tropical workers, and in the "Memoranda on Medical Diseases in Tropical and Sub-tropical Areas" (1930) it is stated that plasmoquine has not fulfilled its early promise.

This is a curious situation, for usually it is the other way about; laboratory workers and clinicians at home frequently find that remedies are excellent, whereas the tropical worker frequently finds them useless.

The discrepancy in results has given rise to much discussion and, it is suggested, may be explained by various factors: (1) That the cases in the tropics may have developed or been allowed to develop some immunity before the drug was administered. (2) That the strain of parasite, especially in India, may be very mild. (3) That the period of observation after treatment is not long enough.

These suggestions appear to be quite reasonable, and a study of the various papers relating to the treatment of British soldiers in India appears to support suggestion No. 3, in that the period of observation after treatment was not long enough. The period of observation after treatment with plasmoquine and quinine in Manifold's cases (1931) was six months, in Sinton, Smith and Pottingers' cases (1930) eight weeks, and in Jarvis' cases (1932) twelve weeks.

This paper is an attempt to form a sequel to Manifold's, in that: (1) Cases treated with plasmoquine and quinine have been carefully observed over a period of from three and a quarter years to a minimum period of ten months. (2) Cases have been separated into primary infections and relapses. (3) Cases were most carefully investigated in the endeavour to find out where the infection was originally contracted and, as will be seen, many of the cases were infected, not in India, but in China, Burma, etc.

The writer has been in charge of all the cases of malaria admitted to the Connaught Military Hospital, Poona, for the past four and a half years. For one and a half years over 250 cases were treated with quinine alone, and he was in a position to judge the results of the two treatments, all the other factors being the same, the only difference being the reduction in the amount of quinine given and the addition of plasmoquine. The relapse rate on quinine alone was 25 per cent. Since the commencement of plasmoquine treatment on July 7, 1929, in all 600 cases have been treated, 100 of these in 1932, and although none of these has relapsed up to October 13, 1932, they are not included in the figures for working out the relapse rate. The 600 cases included all types of malaria infection—*P. vivax*, *P. falciparum*, *P. malariæ*, and a mixture of all three. No case of infection with *P. ovale* was noted. The patients included officers, other

ranks, women and children (no non-European cases are included in the series).

All cases were diagnosed microscopically and the treatment was instituted at the earliest possible moment, often within ten minutes of admission to hospital. There was no attempt to allow a patient to develop any tolerance or immunity; on the contrary, speed in diagnosis and giving treatment was aimed at, and if an extra dose of quinine had to be given it was invariably given in the first twenty-four hours.

Almost always in primary cases a lag period was noted, in which the fever was present but parasites were not found for twenty-four to forty-eight hours. This is in keeping with James's findings.

Source of Infection.

The majority of cases were infected at Poona or Kirkee. Every patient was carefully questioned, and as far as possible every endeavour was made to find out where and when he had been infected.

In 1930 a new battalion arrived in Poona direct from Hong Kong where it had been heavily infected with malaria: this battalion furnished most of the relapse cases in 1930 and during the early part of 1931. In 1931 another battalion arrived from Shanghai, moderately infected; this battalion furnished most of the relapses in 1931.

In 1929 one battalion came from Quetta. There were also cases which had been infected originally in various parts of India and Burma,

Records.

A careful follow-up system was employed. Every patient who had been treated with plasmoquine and was still in the station, was inspected personally every six months. In the case of patients who had left the station, a questionnaire was sent to their medical officers to find out whether they had relapsed. Ninety-five per cent of the patients treated with plasmoquine were thus traced, some three and a quarter years after treatment.

Treatment in the Pre-plasmoquine Period.

As mentioned before, the writer treated 250 cases of benign tertian malaria in the pre-plasmoquine period with the usual standard method as was then laid down for India, i.e., quinine sulphate 30 grains daily for about ten to fifteen days, depending on the case. This was followed by a post-hospital quinine course of 10 grains daily for two months; a tonic mixture of iron and arsenic was also given. The treatment was personally supervised and presumably efficiently carried out, but it struck the writer that the more efficiently it was done the more likely was the patient to relapse. Patients used to relapse several times during the year, sometimes during their post-hospital quinine course or immediately after it.

In 1928 ten cases were transferred to Kasauli, the Malaria Treatment Centre, as they had relapsed more than three times in the year and were

considered to be a nidus of infection in their battalion. The relapse rate for the 250 cases treated was over 25 per cent.

Plasmoquine Period.

Numbers treated with plasmoquine and quinine from July, 1929, to October, 1932.

B.T. primary	263
B.T. relapse	141
M.T. primary	168
M.T. relapse	10
Mixed infection	13
Quartan..	5
Total	600

Note.—A primary case is one whose documents do not show evidence of a previous attack of malaria of the same type.

A relapse case is one in whose documents there was an entry for the same type of malaria within eighteen months. This period is purely arbitrary, but it is considered well within the limits of the ordinary relapse. In James's series of eighty-one controlled cases only one relapse occurred after a year, all the others occurred in under one year.

In July, 1929, treatment with plasmoquine and quinine was begun, and an interim report on the first 108 cases treated was submitted to Major Manifold in April, 1930. This report is incorporated in his article in the Journal of the Royal Army Medical Corps, 1931.

The writer's conclusions as regard the value of plasmoquine have in no way been modified by a further two and a half years' experience in the treatment of another 500 cases.

Description of the Drug (A Bayer Product).

Plasmoquine is not synthetic quinine although the molecular weight and the chemical formula of both are remarkably alike.

Plasmoquine formula : $C_{19}H_{29}ON_3$. Synonym "plasmochin." Molecular weight : 315.

Quinine formula : $C_{20}H_{24},O_2N_2$. Molecular weight : 324.

Plasmoquine is known chemically as N-diethylamino-isopentyl-8 amino-6 methoxy-quinoline.

A chloral hydrate salt easily soluble forms its basis. It is a tasteless, bright yellow, and very stable powder practically insoluble in water. The contents of the tablets are hydrochlorate of plasmoquine.

In looking through the literature one is confused by the various names under which it appears. A list of the plasmoquine preparations at present in use with their plasmoquine content and doses is given for reference.

For Oral Administration.

(1) Plasmoquine Simplex. 1 tablet = 0·02 gramme or $\frac{1}{3}$ of a grain of plasmoquine.

(2) Quino Plasmoquine Quinoplasmine). Plasmoquine : quinine = 1-30.

1 tablet = 0·01 gramme ($\frac{1}{6}$ grain) plasmoquine plus 0·3 gramme ($4\frac{1}{2}$ grains) quinine sulphate. This name was chosen to avoid any confusion with plasmoquine simplex and plasmoquine compound.

(3) Plasmoquine Compound. Plasmoquine: quinine = 1:12.5. 1 tablet = 0·01 gramme ($\frac{1}{6}$ grain) plasmoquine plus 0·125 gramme (2 grains) quinine sulphate.

Note.—The proportion of plasmoquine to quinine is much greater in plasmoquine compound than in quino plasmoquine, otherwise they are the same.

For Intravenous or Intramuscular Injection.

(1) Plasmoquine Simplex. 1 per cent solution in ampoules. 1 cubic centimetre = 0·01 gramme or $\frac{1}{6}$ grain of plasmoquine.

(2) Quino Plasmoquine (Quinoplasmine). Plasmoquine : quinine=1-30 in ampoules of 2 cubic centimetres. 2 cubic centimetres = 0·02 gramme plasmoquine plus 0·6 gramme (9 grains) quinine acid hydrochlor.

The preparation used throughout this series of cases was plasmoquine simplex in doses of 0·02 gramme and 0·01 gramme.

Treatment of Infection with *P. vivax* and *P. malariæ*.

The original dosage was one tablet of plasmoquine simplex 0·02 gramme with one ounce mistura quinine sulphate (10 grains to the ounce) given twice daily for twenty-one days.

The dosage of plasmoquine was reduced in September, 1930, to 0·03 gramme daily—the dose of quinine remaining the same. The dosage of plasmoquine was continued right through the series, but in Septmber, 1931, quinine acid hydrochlor. was substituted for quinine sulphate.

The morning dose was given after breakfast, the evening dose twelve hours later. The treatment for the first ten to twelve days was given in hospital, and for the remaining period of the twenty-one days the patient attended as an out-patient twice daily.

In a few cases (8 per cent) it was found necessary to give an extra dose of quinine, usually only in the first twenty-four hours. In one case intravenous quinine was given as the patient was not absorbing quinine and the temperature was keeping up. It was at first thought to be a case of malignant tertian infection. No post-hospital quinine and arsenic course was given. All treatment ceased after the twenty-one days' course was finished.

No other medicine except calomel, magnesium sulphate, and an occasional tablet of aspirin or phenacetin was given.

All patients were kept in bed for at least four to six days after admission. They were usually kept in hospital from ten to twelve days. In the interim report it was suggested that eight days in hospital was long enough, but further experience showed that a minimum of ten days was essential.

Patients were excused duty for the remaining period of the twenty-one days necessary to complete the course; if for any reason a patient missed

a day's treatment, the period of excused duty was automatically extended. It was found absolutely necessary to keep men from doing strenuous work while they were attending for their twenty-one days' treatment.

Toxic Effects.

With the 0·04 gramme dose of plasmoquine daily there was definitely a slight cyanotic or greyish tinge noticed and one could always pick out the men in the ward who were on plasmoquine; it was especially noticeable in men who were attending hospital. The patients themselves did not notice it nor did they complain in any way. Men who were constipated appeared more prone to this cyanotic tinge. In the few cases in which cyanosis was marked, discontinuance of the drug for a few days with a brisk purge rendered the patients able to continue their course almost at once. It would appear that plasmoquine is cumulative. The reduction of the dose to 0·03 gramme daily prevented any cyanosis whatever.

A few cases complained of abdominal pain when they were asked about it. One man developed severe colic, but was removed to the operating theatre by an enthusiastic surgeon and had his appendix removed. It was never clearly proved whether his colic was due to appendicitis or plasmoquine.

One officer patient developed jaundice while attending for completion of his course on about the fifteenth day. He had no other symptoms suggestive of plasmoquine poisoning. It was never clearly explained to what his jaundice was due.

Tachycardia occurred in six cases. In all of these it was found that the men had either been put on duty or had been indulging in violent exercise while attending for treatment.

The urine of every case was fully tested and except for a few cases of transient albuminuria, nothing abnormal was found.

The dosage of 0·03 gramme plasmoquine with twenty grains of quinine sulphate or hydrochloride was sufficient in most cases to bring the temperature down on the second day. In a small percentage of cases (eight per cent) it was found necessary to give an extra dose of quinine for a few days. The dosage of plasmoquine was never increased.

Benign Tertian Relapses.

To avoid the criticism that cases have not been under observation for a sufficient length of time, only those cases treated up to the end of 1931 have been included in calculating the relapse rate. None of the forty-eight cases treated in 1932 had relapsed up to the end of 1932.

The nomenclature for relapses is that of James.

(1) Recrudescence means a return of fever and parasites within eight weeks from the primary attack.

(2) Relapse means a return of fever and parasites after eight weeks but in less than twenty-four weeks.

(3) Recurrence means fever and parasites later than twenty-four weeks.

Primary Benign Tertian Cases.

Of the 215 cases of primary benign tertian malaria treated between July 12, 1929, and December 31, 1931, nine had a return of fever and parasites, i.e., 4·18 per cent. Of these nine cases, none were recrudescences. Four were relapses. Five were recurrent.

	Date and place of primary attack	Date of further attack	Period from end of primary attack
Case No. 1	Poona, 11.10.29	4.3.30	22 weeks, relapse
Case No. 2	Poona, 18.10.29	14.7.30	36 weeks, recurrence
Case No. 3	Poona, 11.12.29	3.4.30	15 weeks, relapse
Case No. 4	Kirkee, 29.6.30	6.10.30	13 weeks, relapse
Case No. 5	Poona, 4.9.30	10.8.31	47 weeks, recurrence
Case No. 6	Poona, 3.7.30	21.1.31	28 weeks, recurrence
Case No. 7	Kirkee, 18.7.31	6.4.32	38 weeks, recurrence
Case No. 8	Quetta, 27.7.31	20.5.32	37 weeks, recurrence
	(This man was not originally treated by the writer)		
Case No. 9	Poona, 24.8.31	8.2.32	22 weeks, relapse

Benign Tertian Relapses.

These were 141 cases originally treated with quinine alone which relapsed and were then treated with plasmoquine and quinine. Of these 6 relapsed again after plasmoquine : i.e., 4·7 per cent.

Of these 6—1 was a recrudescence; 1 was a recrudescence and later recurred; 3 were relapses; 2 were recurrences (includes case which recrudesced).

Case No.	Date and place of primary infection	Relapses on quinine and dates of	Date of first treatment with plasmoquine	Date of relapse on plasmoquine
10	28.11.27 Hong Kong	8.7.28, recurrence 17.11.28, relapse 4.8.29, recurrence 24.11.29, relapse 3.8.30, recurrence	3.8.30	21.12.30, 19 weeks
11	19.11.28 Hong Kong	17.7.29, recurrence 3.2.30, recurrence 29.3.30, recrudescence	29.3.30	8.5.30, 5 weeks 10.7.32, 2 years and 2 months
12	23.11.28 Hong Kong	18.3.30, recurrence	18.3.30	10.8.30, 21 weeks
13	1.10.29	30.4.30, recurrence	30.4.30	14.6.30, 6 weeks
14	21.11.28	19.11.29, recurrence 30.4.30, relapse	30.4.30	9.10.31, 75 weeks
15	29.6.28 Poona	30.7.29, recurrence	30.7.29	11.11.29, 13 weeks

Plasmodium falciparum Infections.

There were 178 cases ; of these 52 were treated in 1932.

The treatment for *P. falciparum* infections was with quinine acid hydrochlor. alone for the first four or five days, 10 grains, t.d.s. Plasmoquine simplex 0·04 gramme or 0·03 gramme was given for five days prior to discharge from hospital.

These patients were attended by their regimental medical officer for ten days after discharge and received quinine acid hydrochlor. 10 grains daily with mistura ferric arsenic.

The type of *P. falciparum* on the whole was very mild and in only

fifteen cases was it found necessary to give intravenous quinine. Crescents were never found in any case treated with plasmoquine. There were three deaths, all from *P. falciparum* infection ; all the men were transferred from out stations and died shortly after admission.

The relapse rate was very small, two per cent in 126 cases. One case recrudesced three times. No appreciable difference was noted between the relapse rate on plasmoquine and that on quinine alone.

Quartan Infection.

The treatment was the same as for benign tertian infections. There were no relapses.

Mixed Infections P. vivax and P. falciparum.

These were treated as for malignant tertian infections. There were no relapses of a mixed infection, but in several cases the patient was re-admitted for *P. vivax* infection and was treated with a full course of plasmoquine and quinine. These did not relapse.

Women and children take plasmoquine well. There was no evidence of intolerance or idiosyncrasy.

Two cases of accidental overdose of plasmoquine with definite symptoms of plasmoquine poisoning occurred in 1928. Two patients, both chronic relapsing infections with *P. falciparum*, received plasmoquine simplex 0·32 gramme or 5·13 grains for two days before the error was discovered. On the third day it was noticed that both of them were very cyanosed: face, ears, lips, fingers and neck. Neither of them complained until the fourth day, when Case " A " developed incessant vomiting with epigastric pain. On this day he had a slight rise in temperature, and on the fifth day he appeared to have a transient attack of nephritis. The urine contained casts, granular and hyaline, with albumin in large quantities, no red blood-corpuscles, but much hæmoglobin. The amount of urine passed was much reduced. On the sixth day the urine was normal except for the presence of leucin and tyrosin crystals. On the seventh day the patient was less cyanosed, but jaundice was well marked. On the eighth day he improved and gradually recovered. There were no leucocytes throughout. The clinical symptoms suggested blackwater fever. The treatment given was intravenous glucose and saline. The second patient, except for extreme cyanosis, presented no symptoms.

It is interesting to note that both cases recrudesced several times later with malignant tertian infection.

SUMMARY.

(1) Six hundred cases of malaria were treated in three and a half years with plasmoquine and quinine with practically no toxic effects.

(2) In 215 cases of *P. vivax* primary infections were observed over an average period of two years; the relapse rate was 4·1 per cent. In 141 cases of *P. vivax* relapse cases the relapse rate was 4·7 per cent.

(3) The dose of 0·03 gramme plasmoquine with 20 grains of quinine acid hydrochlor. daily for twenty-one days was found to be very satisfactory for *P. vivax* and *P. malariæ* infections.

(4) A hundred and twenty-six tertian cases were treated with quinine acid hydrochlor. 30 grains daily for twelve days, plus plasmoquine 0·03 gramme daily for five days prior to discharge from hospital, followed by a course of ten days quinine acid hydrochlor. 10 grains. The relapse rate was 2 per cent.

These results go to confirm those obtained by Manifold, Sinton, Jarvis and other workers, that is, that a combination of plasmoquine and quinine is effective in reducing the relapse rate in *P. vivax* infections among British troops in India.

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Editorial.

MALARIA.

In an Editorial on the State of the Public Health we referred to some of the most recent work on malaria outlined in Sir George Newman's Report.

The new knowledge has been largely obtained from the study of malaria purposely induced in patients suffering from general paralysis. Wagner Jauregg began the treatment of general paralysis by artificially infecting the patient with malaria parasites; this led Colonel S. P. James to introduce natural inoculation through the mosquito, and so to formulate a method by which clinical and therapeutic tests could be carried out on the human subject in Europe.

Colonel James carried out his investigations at the Horton Mental Hospital. His practical object was to induce a pure infection of benign tertian malaria in patients to be treated. The strain of *Plasmodium vivax* used in his early work was obtained from India; this strain was lost during an unavoidable interruption of the work and a strain obtained from Madagascar was then employed. The mosquitoes (female *maculipennis*) were collected in the adult stage in a country district where malaria does not occur. Between 1923 and 1926, about 3,200 mosquitoes were used in 22 batches, but only 715 lived long enough to be available for infecting patients. During the period 221 patients were subjected to bites and 169 developed benign tertian malaria within the usual incubation period of the disease. In 1926, Colonel James furnished a report on the first results of laboratory work on Malaria in England to the League of Nations.

Discussing the factors relating to the transmission of malaria from man to the mosquito, he states that a small number of patients suffering from malaria are infective to anopheles, a very small minority being "good infectors." In a first attack of malaria gametocytes are not seen until the seventh day and do not become infective to mosquitoes until the tenth day of the illness. In relapses, on the other hand, gametocytes are usually seen on the first day on which the occurrence is reported. Of great importance is the number of feeds; unless the patient is an exceptionally good infector of anopheles it is necessary to feed the mosquitoes several times in order that sporozoites may be found in the salivary glands. Human blood is the only satisfactory food; certain fruits are unfavourable to oöcyst development. The length of life of the mosquito is another very important point; *maculipennis* can withstand very low temperatures, but its mortality above 22° C. is high. Sporozoites were not killed when the mosquito lived for

three weeks at 4° to 5·5° C. Growth and development of oöcysts is arrested at low temperatures, but begins again when the temperature becomes sufficiently high. These observations support the findings of Swellengrebel in Holland, Wenyon in Macedonia, and Sella in Rome. There is now no doubt that *P. vivax* can be carried through a severe winter in hibernating mosquitoes and the carriage may be in the oöcyst or sporozoite stage, or in both. The infected mosquito carries zygotes at different stages of development; these zygotes rupture at different times and the salivary glands are constantly being replenished with sporozoites. As a result of his observations on the transmision of malaria from mosquitoes to man, James came to the conclusion that relapses were not more frequent in patients infected by a large dose of sporozoites or by infection on several occasions. The qualities of the blood and of the tissues of the individual are much more important than the degree or frequency of infection. There seems to be no doubt that some persons are extremely susceptible to infection and others are relatively quite refractory.

Reviewing the laboratory work and assuming that what happens in artificial laboratory conditions will also happen in nature, James concluded that of the vast numbers of anopheles mosquitoes which exist in malarious places only a few become transmitters of malaria; he explains the fact that most of the inhabitants of the places become infected with the disease as being due to a mosquito retaining its infection for long periods and being able to infect many people. He found that some of his mosquitoes after biting thirty to forty patients still had numerous sporozoites in the salivary glands, because these were replenished with sporozoites from oöcysts ripening at different times. He thinks that the reason why in nature so few mosquitoes become transmitters of malaria is that they do not become infective unless they have an opportunity of feeding several times every day on an infective patient and take no food other than human blood. The role of malaria-transmitters is therefore reserved for only a few individual mosquitoes which pass their life in a favourable environment, and in a manner very different from that of the remainder of the brood. If this view is accepted the secret of successful control of malaria must be in a particular and exact knowledge of the few individual mosquitoes which are likely to get into a special environment. An essential point in the behaviour of these mosquitoes is that instead of flights in the open-air they pass most of their life in the particular house in which they first settled, and sheltered in some particular dark corner they night after night gorge themselves with blood taken from some occupant of the room. James considers that his laboratory work confirms the view of many epidemiologists that in Europe the dwelling is the laboratory where malaria infection has its origin and is cultivated. This was one of the reasons that led the Malaria Commission of the League of Nations to advise that in the European countries which they visited it would be best to deal with endemic malaria by measures which would be limited to affected individuals

and to the interior of the houses in which they lived. In support of this recommendation it is pointed out that Stephens and Christophers working in Africa in 1899 and 1900 gave striking examples of fever houses in which infection persisted for weeks or months.

The persistence of infectivity in mosquitoes through the winter months explains some of the occurrences in Northern Europe of primary attacks of malaria during that season and in early spring.

The clinical observations at Horton of the induced disease showed that n a primary attack of benign tertian malaria there is an initial stage of gradually increasing irregular fever lasting from two to five days. The fever is remittent at first, but towards the end of the stage it is intermittent. In the developed stage which follows the primary stage the fever is quotidian in 80 per cent of the cases; this stage lasts ten days. The terminal stage is characterized by the fever changing from quotidian to tertian type. On examining the blood of a patient bitten only by one mosquito James found that though at first the parasites showed only one stage of development, in later examinations on the second and third day of fever parasites in two or three stages would be found. The irregular fever is probably the clinical expression of these different groups of parasites sporulating at different times. The group which is least numerous gradually disappears, and towards the end of the attack there is only one group of parasites left, and the temperature assumes the tertian type.

In a second attack resulting from a new infection by mosquito bites the fever shows a true tertian periodicity. There is no stage of quotidian fever. The parasite findings resemble those of a primary attack. But after four or five typical tertian paroxysms a second group of parasites may exert their influence, and the fever then changes from tertian to quotidian type.

A relapse usually has the clinical characters of a second attack, but gametocytes can be found earlier than in a fresh infection.

Though there is such a striking difference between the clinical type of the second attack and the first attack, James does not think that the quality which the patient acquires is necessarily that of possessing immune bodies, which if present in sufficient amount destroy the parasites, as suggested by Yorke and Macfie; it may be due to a modification of the normal chemical reaction of the blood or a change in its content of lecithin or other proteins.

Gordon Thomson states that while attempts to demonstrate the presence of protective antibodies have so far been unconvincing, the evidence derived from serological and other studies tends to support the view that such antibodies do exist. He believes that phagocytosis undoubtedly plays an important part as a controlling factor in malaria infections of man. It may be observed in the peripheral blood and also in smears of internal organs and is not confined to the ingestion of free pigment and dead parasites.

In August, 1927, a study of malignant tertian malaria was begun. A tentative trial of malariatherapy with *P. falciparum* was commenced for the treatment of those patients who had not benefited greatly from a course induced by one or other of the benign parasites. Three strains of *P. falciparum* from India, three from Sardinia, three from Rome, and two from West Africa were employed in these investigations.

Two problems were of outstanding interest: (1) Was there more than one species of *P. falciparum*, and (2) if so, did they vary in malignancy?

James and his co-workers could not find any morphological differences in the strains from India, Sardinia, Rome or West Africa. Only one species seemed to be concerned, and it corresponded with the classical description of the Italian malignant tertian parasite, *P. falciparum*. In 1898-99 Koch came to the same conclusion from his studies in Italy, Africa, America, and the Dutch West Indies. The idea that there are several species seems to have arisen from a study of the clinical observations which appeared to show that there was a separate quotidian form as well as the classical Italian tertian form. Marchiafava and others agree that it is very difficult to make a differential microscopical diagnosis between the supposed quotidian and the tertian parasites. James thinks it is not unlikely that another malignant species will be discovered, though at present the existence of the quotidian parasite has not been definitely proved.

The work at Horton enabled a definite opinion to be formed as regards the second problem. The geographical races, while not being morphologically different, could be recognized as distinct by their clinical virulence, immunological reactions and other biological properties.

It was found that the cases infected with the Rome or Sardinia strains were much more severe than those infected with the Indian strains. The dose of quinine required to control a primary attack caused by the Rome or Sardinia strains was eight times greater than that required for a primary attack caused by the Indian strains. The cases in the Rome and Sardinia groups also continued to relapse for a much longer period than the Indian cases. It was also found impossible to infect the English *maculipennis* with the Indian strains of *P. falciparum*, but when similar experiments were made with the European strains from Rome and Sardinia, batches of infected mosquitoes were prepared without difficulty. Wenyon in Macedonia, Roubaud in France, and Misseroli in Italy also succeeded in infecting a European race of *maculipennis* with European strains of *P. falciparum*. James states that he cannot find in the literature any instance in which a European race of *maculipennis* has been infected with an Indian or African strain of *P. falciparum*.

The temperature curve in malignant malaria was carefully studied at Horton and it was recognized that a remarkable feature of the disease was the presence of two, three, or even more groups of the parasite which continue to sporulate at their regular times without being suppressed by one or two predominant groups. This is the most important respect in which

the malignant parasite differs from the benign parasites *P. vivax*, *P. malariæ* and *P. ovale*.

Clinically malignant tertian malaria is an acute disease consisting of a severe primary attack followed by several less severe recrudescences occurring at relatively short intervals. In this respect it differs from benign tertian malaria in which there are in addition to recrudescences, much later manifestations, which James calls relapses, viz., return of fever and parasites within eight to twenty-four weeks, and recurrences in which fever and parasites return later than twenty-four weeks.

As a result of his observations James considers that the following conditions influence the therapeutic effect of quinine on the clinical and parasitological course of malaria: (1) the mode of infection, (2) the degree of susceptibility to malaria of the patient, (3) the degree of tolerance or immunity which the individual had acquired before the commencement of the quinine treatment, (4) the species of parasites concerned, (5) the virulence of the particular geographical race of the parasite, (6) the dose of infection.

The degree of immunity or tolerance is important and has a great influence on the subsequent course of the disease. The first recrudescence is less severe than the primary attack, and each subsequent recrudescence still less severe until the patient becomes so tolerant that, though parasites may be still present in the peripheral blood, there are no clinical signs.

All therapeutic trials of any system of quinine treatment must be on cases which are in exactly the same stage of the disease. It is often stated that malignant malaria is easier to treat in hospitals in England, the reason being that the cases are always recrudescences, never primary attacks.

The necessity of investigating separately the therapeutic effect of quinine on each of the different species of parasite is now everywhere insisted upon. The same strain must also be used.

As regards the dose, James found in general that primary attacks of cases infected by the bites of many mosquitoes were more difficult to cure and of longer duration than are primary attacks of cases infected by the bites of one or two mosquitoes.

In a later paper, James stated that out of 18,000 female mosquitoes only 5,862 were available for infecting patients. The strain of *P. vivax* obtained in May, 1925, was still being used in 1931, and had not changed as regards its morphological characters or virulence. Out of 1,356 patients, 985 developed benign tertian malaria.

Patients who had a "spontaneous recovery" from the primary fever were found to be still infective in the following fever-free interval, as parasites were still present in the blood. But after a spontaneous recovery from a recrudescence patients were not infective to mosquitoes, as there were not sufficient gametocytes present in the blood.

The infectivity of a case is not now judged by the number of gametocytes,

but by (1) the number of exflagellating males with reference to the number of leucocytes, and (2) the time required for complete exflagellation in a saturated atmosphere at 25° C. The number of zygotes in the stomach of the mosquito is increased by the number of feeds; in heavily infected insects the zygotes are distributed almost equally over the whole stomach and in the lightly infected they are present towards the posterior end only.

Of batches of mosquitoes prepared in April and May, less than ten per cent lived until the batch became infective, but of batches prepared between August and November, at least fifty per cent of the mosquitoes were available for infecting patients.

The finding of sporozoites in the salivary glands of a mosquito after biting is not considered to be good evidence that sporozoites were injected by that mosquito when it bit the patient. It is suggested that the sporozoites, in addition to being present in the salivary glands, must be lying free in the common salivary duct of the mosquito at the time of biting. Some of the failures to infect patients in 159 cases were attributed to this cause. Others might have been due to anæmia, the blood not being a good medium for the malaria parasite.

Failures may also be due to previous attacks. When there has been a recurrence followed by "spontaneous recovery," endeavours to bring on a fresh attack by re-infection with the same parasite fail.

Immunity to re-infection by *P. vivax* did not confer protection against infection by *P. falciparum*. An even more remarkable finding was that complete immunity to re-infection by one strain of *P. vivax* did not confer protection against another strain of the same species.

The records at Horton contained cases in which the expected malaria attack did not develop until six months or more after the patient was bitten by infected mosquitoes. The infection remained latent. Swellengrebel, De Buck and Swellengrebel de Graaf have reported a similar series of cases in healthy persons who volunteered for the experiment.

In primary infections, a concurrent mixed infection with two species of the malaria parasite cannot often be demonstrated, because one species quickly becomes predominant and the other disappears until the attack caused by the predominant species is over. Benign tertian seems to predominate over both quartan and malignant tertian.

The spring rise in the seasonal incidence of natural tertian malaria is considered to be due to recurrences in persons who had their primary attack in September, together with primary attacks in persons whose infections in September remained latent throughout the winter.

The possibility of prophylaxis by quinine was tested by James. He gave quinine in various ways in an endeavour to kill the sporozoites injected by mosquitoes and the trophozoites resulting from them during the incubation period. Quinine given before infection and daily during the incubation period did not kill the sporozoites, but it prevented parasites appearing in the peripheral blood for eight and nine days after the commence-

ment of the daily fever paroxysms, which appeared when the prophylactic doses were stopped. In a second experiment, quinine was given daily and continued for a long time after the expiry of the incubation period. A mild clinical attack, lasting only two or three days, appeared at the end of the incubation period; at the end of a fortnight another mild attack appeared, and so long as the person continued to take the prophylactic dose of quinine these mild clinical attacks occurred at irregular intervals. If a person neglected to take the dose he went down with a frank clinical attack in three or four days. In the third type of experiment, a larger dose (fifteen grains) was given once a week; this was not so effective as taking a small daily dose.

When infection takes place by direct blood-inoculation, as in the experiments reported by Yorke and Macfie, quinine given before and after inoculation is quite effective. In these cases, only the forms which live in red corpuscles are injected. In the natural method of infection, the parasite has lived in the walls of the stomach and the salivary glands—in tissue cells—and has not been dependent on blood for its nutriment. Evidently, quinine has not the same action on a tissue parasite as on the blood-cell forms. Relapses and recurrences are rarely seen in the inoculated cases, but occur in fifty per cent of the mosquito-infected cases. What happens to the sporozoites in the long delayed cases? It has been supposed that they enter the connective tissue cells or the cells lining the capillary blood-vessels, and remain there until the cells break down eight or ten months later. Another explanation offered is that the sporozoites actually penetrate the blood-corpuscles as Schaudinn described, while the merozoites are merely attached to the corpuscles.

The practical point as regards quinine prophylaxis is that while the parasites are not killed, the clinical manifestations are suppressed, so that bodies of men such as troops in the field, crews of ships, or labourers on particular work, can carry on their duties for a limited period, which may be of prime importance from a Service point of view. James believes that when quinine is taken there is not the same immunity as appears after recurring attacks of malaria, and in exceptional circumstances, such as very severe work or prolonged exposure to the sun, the men may suffer from a severe clinical attack of fever.

Evidently no general rule can be given and whether quinine should be given prophylactically will depend on the particular circumstances, especially the frequency with which men are subjected to infection and re-infection.

The problem of the synthesis of anti-malaria preparations has been investigated for some years in the Bayer-Meister-Lucius Research Laboratories at Elberfeld by Dr. Schulemann and his colleagues.

The assessment of the value of these preparations was made possible by the method of using canaries worked out by Roehl in 1926. The birds

were infected by direct blood inoculation. In October, 1931, Colonel James visited Elberfeld and suggested that it was necessary to transmit the malaria from one bird to another by means of the mosquito and not by direct injection of infected blood. Several strains of the proteosoma type of avian malaria parasite must also be used; and tests must be made with the halteridium type of parasite of which the asexual cycle is passed in endothelial cases. Dr. Kikuth immediately instituted tests on these lines. On the basis of toxicological and chemo-therapeutic properties plasmoquine was selected for tests in 1925. In naturally acquired human malaria the action of plasmoquine was demonstrated by Rochl, who was the first to discover that it destroyed the gametocytes of *P. falciparum* within a few days. The work of Sinton, Knowles, Wallace and Manifold has demonstrated that with plasmoquine combined with quinine it is possible to reduce the relapse rate of tertian malaria from fifty per cent. to between two and five per cent. Quinine acts effectively on the schizonts of *P. falciparum* and allays the acute clinical symptoms, plasmoquine has practically no effect on the subtertian schizonts but it definitely destroys gametocytes in a few days. The idea that plasmoquine can inhibit the formation of gametocytes has not been confirmed. The work of Barber, Komp and Newman, Withmore, Roberts and Jantzen in Central America, has, however, definitely proved that even minimal doses of plasmoquine, which are too small to cause the gametocytes to disappear, nevertheless render them incapable of infecting anopheles.

James made a prophylactic experiment with plasmoquine at St. Mary's Hospital and concluded that it is a true prophylactic, but that the daily dose requisite for ensuring complete protection in all circumstances would be too near the toxic dose to be safely taken for more than a few days. What is required is a drug with the same action as plasmoquine but of less toxicity to the human host.

James and his co-workers treated seventeen cases of malignant tertian fever with 0·3 g. of atebrin for five days; in only one case was there a failure to effect a permanent cure, and even in this case further treatment with the same dose for seven days was followed by quick recovery and no further recrudescence. All the cases were under observation for several months. In each case arrangements were made to eliminate the errors in chemo-therapeutic trials previously noted. The strains of *P. falciparum* employed were either from Rome or from Sardinia. Quinine had been proved to be so ineffective against these particular strains that permanent cure by its means could not be brought about.

There is urgent need for further research on the life history of sporozoites in the human and insect hosts, for James's experiments show that plasmoquine is more effective for preventing malignant tertian than it is for preventing benign tertian malaria. He deduces from his work that malaria must be studied in terms of the different species of parasite concerned; and in terms of the various phases of each parasite.

There must be a sporozoite therapy, a schizont therapy, and a gametocyte therapy. Moreover, these subjects must be studied in terms of geographical strains of the different species.

Antimalaria chemotherapy has thus become an exceedingly complex research problem. But we must not come to decisions on laboratory trials alone ; it is important to determine whether an antimalaria drug has the same action on a particular strain occurring in an indigenous native in the tropics as it has on the same strain occurring in a European in England. Professor Schulemann has sent Colonel James a record of clinical trials in Africa which indicate that among natives in that country plasmoquine in a daily dose of only 0·02 g. may be an effective prophylactic.

These results and those obtained by Barber and others in Central America may possibly explain the reduction in malaria observed by Colonel Hanafin in Burma.

Clinical and other Notes.

LEISHMANIASIS (KALA-AZAR) IN AN ADULT CONTRACTED IN MALTA.

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AND
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Leishmaniasis in Malta is almost entirely confined to children. A few cases have been reported in the Royal Navy, and during the War one or two cases were reported amongst the personnel of the Army stationed in Malta. It is possible, however, that these cases may have contracted the disease elsewhere. We understand that the disease has never been seen in adult Maltese.

The case under review, therefore, would seem to be worthy of record as the disease was definitely contracted in Malta.

Gunner S., aged 22, arrived in Malta from England in 1930. He had never been out of England before and he did not land at any ports on the journey. During his tour of duty in Malta, he was stationed continuously at Tigne Barracks, except for fourteen days at a healthy outfort in October, 1931.

Previous History.—There was an admission for sandfly fever in 1931, but no other previous history of interest.

On admission on January 21, 1932, the patient complained of not having felt fit the previous day and was then suffering from vomiting and a feeling of vague discomfort in the abdomen. Temperature 97·8° F., pulse 62. The tongue was coated and constipation was marked. No physical signs were apparent and the liver and spleen were not palpable. That evening the temperature was 102·6° F., and the vomiting was worse.

On the second, third and fourth days the patient felt better, but his temperature remained between 102° F. and 104° F., with are latively slow pulse. An enema was necessary to relieve the constipation.

On the fifth day the temperature still remained high, but the patient felt better. The spleen was just palpable.

From the seventh day the temperature gradually fell until it reached normal on the tenth day when the patient felt fit, but the spleen was still palpable.

From the tenth to the seventeenth day there was a period of apyrexia, but the spleen could just be felt.

On the evening of the eighteenth day the temperature rose to 99° F.,

and a rise each evening continued until the twenty-seventh day. The patient felt quite well during this period and, except for an occasional attack of tachycardia and the slightly enlarged spleen, appeared well.

On the twenty-eighth and twenty-ninth days the patient suffered from headache and did not feel up to the mark. The spleen was larger.

From the thirtieth to forty-first day another wave of pyrexia oocurred, the temperature rising 1·5° F. daily. During this period there was nausea, profuse perspiration and considerable prostration. The spleen gradually got larger.

On the morning of the forty-second day the temperature was normal, but rose the next evening to 104° F. From now until the fifty-second day the temperature was very irregular, the pulse-rate increased, the patient's general condition became worse and he was obviously a sick man. Numerous laboratory investigations had been made, but all without arriving at a diagnosis. The case, which at first presented a clinical picture compatible with a diagnosis of paratyphoid and later of undulant fever, both diseases not uncommon in Malta, was obviously neither, and quinine had been tried without effect. It was therefore decided to try liver puncture. On the fifty-third day the spleen was midway between the costal margin and the umbilicus, but the liver was normal in size. Liver puncture was performed and Leishman-Donovan bodies were found in the smears. The aldehyde test was carried out and gave a positive result. The temperature was recorded four-hourly from now on and showed the typical double remission every four hours.

On the fifty-fifth day a course of neo-stibosan intramuscularly was commenced. The first and second doses were 0·2 gramme and thereafter 0·3 gramme was injected into the buttocks on alternate days. Whilst this course of treatment was in progress there were increasing signs of intolerance, and on the sixty-sixth day the drug had to be discontinued as the patient's condition was so poor; he was suffering from rigors, epistaxis, continual nausea, marked pyrexia and great prostration. There was also considerable loss of weight in spite of a highly nutritious diet, to which had been added marmite, ostelin, cod-liver oil and malt, and fresh fruit juices to ensure a high vitamin content.

On the seventy-third day the signs of intolerance subsided, and the course of intramuscular neo-stibosan was continued with two doses of 0·2 gramme and two of 0·3 gramme. After each of these injections the patient had nausea and occasional vomiting, and there was a prompt rise of temperature up to about 103° F. The total amount of neo-stibosan administered was 2·6 grammes.

After the course was completed the patient began to improve for about ten days; he showed a slight increase in weight, the spleen diminished in size, he felt and looked much fitter and the temperature tended to be lower, but was still hectic.

On the ninetieth day, however, the temperature began to rise again and

the spleen to enlarge. He was carefully watched, and as he was obviously going downhill it was decided to give him another course of neo-stibosan, this time intravenously. This course was commenced on the ninety-fourth day and the dosage for the first two injections was 0·2 gramme, and thereafter 0·3 gramme at intervals of three days. There were no signs of intolerance after any of the injections. Treatment was discontinued, however, after the injection on the 113th day; a total of 2·5 grammes had been administered and it was obvious he was deriving no benefit from it; he was losing weight again, his spleen was getting bigger and his blood-picture was becoming less and less satisfactory, During this course, on the 105th day of the disease, the patient was treated for a short time with a liver preparation, "Xorox," to try and combat the anæmia. There was an almost immediate red cell response, but a big increase in the white to red cell ratio. This is well shown in the graph of the blood-picture. The red cells fell rapidly on the preparation being discontinued.

From now on the patient's condition became rapidly worse and the delayed improvement which one is told *may* be expected after treatment with neo-stibosan was not forthcoming. He suffered from very great prostration, tachycardia and the spleen reached the umbilicus, and on the 130th day of the disease when his condition appeared to be getting critical a course of tartar emetic was commenced.

This drug was given as 1 per cent solution intravenously on alternate days, commencing with a dose of 1 grain and working up with half-grain increases to a maximum dose of 2½ grains, which dose was continued unti the end of the course. The total dosage was 29½ grains. There were no signs of intolerance. The effect was dramatic: the temperature began to fall and was normal on the 141st day and remained so, the spleen rapidly became softer and smaller and the blood-picture and general condition rapidly improved, and on the 163rd day of the disease, after 133 days of almost continuous pyrexia, he was walking about.

He was invalided to the United Kingdom on July 14, 1932.

He was brought before a Medical Board on August 15, 1932, and was found fit for duty.

LABORATORY INVESTIGATIONS.

(1) *Urine.*—No abnormalities were detected during the course of the disease.

(2) *Fæces.*—These were free from ova and cysts. Numerous cultures made in the early stages of the illness were free from pathogenic organisms.

(3) *Blood Examinations.*—Cultures were made on the third, sixth, thirty-fourth, forty-sixth and ninety-first days for pathogenic organisms. All remained sterile after one month's incubation at 37° C., except that taken on January 23, 1932 (the third day of the disease). This culture, at first sterile, after three weeks' incubation was found on being subcultured on to serum-agar slopes to give a fairly rapid growth of a very small Gram-negative cocco-bacillus, not unlike *M. melitensis*. This organism, however,

did not agglutinate with *M. melitensis* or *Br. abortus* serums. Further investigations proved it to be a member of the chromogenic group of organisms.

Cultures were also made on the 125th day of illness in Lockes' semi-solid blood-agar for Leishman-Donovan bodies, but no organisms were recovered; some of the cultures were contaminated.

Widals.—The patient's serum was put up against emulsions of *B. typhosus*, *B. paratyphosus* A, B, and C, obtained from the Royal Army Medical College; the results are shown in the table below as Standard Agglutinin Units. In view of the clinical picture in the early stages, and the organism isolated in the blood-culture made on January 23, 1932, the serum was also put up against nine different strains of *M. melitensis* and one of *Br. abortus*.

TABLE I.

Date	T.	A.	B.	C.	MM.	Br. A
23.1.32	35	260	50	0	0	0
26.1.32	35	260	50	0	0	0
3.2.32	7	111	50	0	0	0
24.2.32	3·5	111	25	0	0	0
26.2.32	Not carried out.				0	0
16.3.32	3·5	55	25	0	Not carried out.	

The patient's blood was also tested with Huddleton's strong emulsion of *M. melitensis* for evidence of undulant fever on several occasions before the diagnosis of Leishmaniasis was established, but it always gave negative results.

Blood-counts.—The summary of all counts carried out is shown in Table II; these are also shown graphically in Fig. 1.

No malaria parasites or Leishman-Donovan bodies were seen at any time.

It will be noted that the findings present almost a book picture.

Liver puncture was made on the fifty-third day, and Leishman-Donovan bodies were found in large numbers in the smears. Culture was not attempted as the material obtained was scanty, and the patient's condition did not warrant unnecessary interference.

Aldehyde Test.—This test was not carried out until after the diagnosis was established by liver puncture. It was subsequently carried out on four occasions, and was strongly positive each time; the last test being made just before the departure of the patient for the United Kingdom.

The most noticeable points in the case are:—

(1) The almost immediate recovery in the hæmoglobin and red-cell picture after the treatment with antimony tartrate was commenced.

(2) Immediate jump in the number of red cells and improvement in the red-cell picture within twenty-four hours of the first dose of "Xorox," together with an increase in the hæmoglobin percentage, but accompanied by a fall in the white cells to their lowest point which caused a very low white to red cell ratio.

(3) The rapid fall in the red cells after "Xorox" was stopped.

(4) The low figure of five per cent for polymorphonuclear leucocytes on April 14, 1932.

(5) The fact that the number of white cells and the white to red cell ratio were about normal when the disease was sufficiently well established for the recovery of Leishman-Donovan bodies in liver puncture.

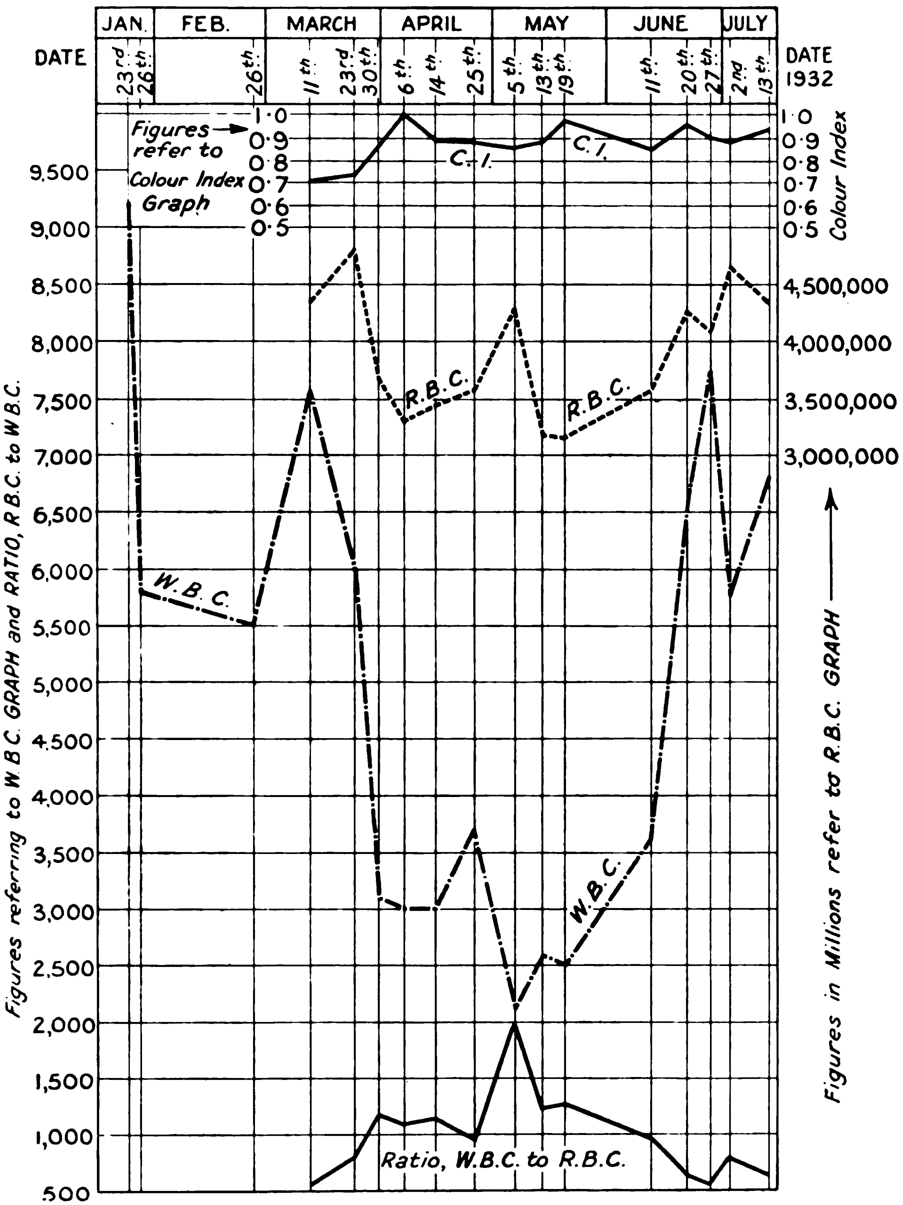

FIG. 1.

(6) The neo-stibosan could not be pressed in the first course owing to the marked intolerance, and although there were no signs of intolerance in the second dose no progress was made.

TABLE II.—SUMMARY OF BLOOD COUNTS.

Date	H.B. per cent.	R.B.C.	W.B.C.	Ratio R.B.C. : W.B.C.	Colour index	Polymorphs	Large lymphocytes	Small lymphocytes	Monocytes	Eosinophiles	Basophiles	Myelocytes	Turk cells	Remarks
23.1.32	—	—	9,200	—	—	50	7	33	9	1	—	—	—	
26.1.32	—	—	5,800	—	—	48	40	—	12	1	—	—	—	
26.2.32	—	—	5,500	—	—	51	16	18	13	1	—	—	—	
11.3.32	60	4,330,000	7,600	1 : 555	0·7	38	15	39	7	1	—	—	—	Liver puncture L.-D. bodies
23.3.32	70	4,800,000	6,000	1 : 800	0·73	35	13	34	16	2	—	—	—	
30.3.32	60	3,660,000	3,100	1 : 1180	0·87	32	3	40	15	3	—	1	1	
6.4.32	70	3,300,000	3,000	1 : 1100	1·05	28	12	36	23	1	—	—	1	Anisocytosis, poikilocytosis, polychromasia well marked
14.4.32	60	3,440,000	3,000	1 : 1147	0·88	5	24	45	25	—	—	1	—	Ditto
25.4.32	60	3,580,000	3,700	1 : 967	0·83	36	14	25	19	2	1	—	3	Ditto
5.5.32	70	4,280,000	2,100	1 : 2000	0·85	41	5	30	23	—	—	—	1	Put on Norox. 4.5.32 Anisocytosis well-marked
13.5.32	55	3,190,000	2,600	1 : 1226	0·88	31	21	23	24	—	—	—	1	Ditto Polychromasia
19.5.32	60	3,160,000	2,500	1 : 1264	0·96	42	16	18	22	1	—	—	1	Ditto
11.6.32	60	3,540,000	3,600	1 : 983	0·85	45	16	22	14	1	2	—	—	R. B. C. improving
20.6.32	80	4,270,000	6,400	1 : 667	0·95	47	9	29	12	—	—	3	—	R.B.C. normal
27.6.32	80	4,100,000	7,700	1 : 522	0·9	36	16	24	18	2	—	3	1	Ditto
2.7.32	80	4,650,000	5,800	1 : 801	0·88	51	8	23	14	4	—	—	—	Ditto
13.7.32	80	4,350,000	6,800	1 : 639	0·93	37	12	34	13	2·5	1	—	5	Ditto

(7) The immediate improvement after tartar emetic was given.

We have to thank Dr. Adler who saw the patient on the 125th day and suggested that as he appeared to be neo-stibosan fast, a course of tartar emetic should be tried.

We have also to thank Surgeon-Lieutenant Commander Rainsford, Royal Naval Hospital, Malta, for help in the laboratory investigations, and Lieutenant-Colonel B. Johnson, D.S.O., R.A.M.C., for permission to forward these notes for publication.

MINERS' NYSTAGMUS AND "SHELL SHOCK."

By LIEUTENANT-COLONEL R. M. DICKSON, O.B.E.,

Royal Army Medical Corps.

THE Medical Research Council recently published the third report of the Miners' Nystagmus Committee.

In this report a more extended examination has been made of the nervous or psychological factors which play an important part in the disability.

It is pointed out that oscillation of the eyeballs, *per se*, is not a trustworthy test for incapacity, since many men with this symptom are working efficiently.

The purpose of this note is, by quoting freely from the report, to draw attention to the close analogy between the general symptoms of miners' nystagmus and the condition known during the War as "shell shock." In the latter disorder, the assumption, on insufficient evidence, that physical forces produced nervous symptoms was so pernicious in its effects that the phrase "shell shock" was prohibited.

It is of the utmost importance that the psychological aspects of these disabilities should be fully recognized.

The circumstances under which the conditions appear are very similar; the arduous nature of the work, the ever present element of danger, and the fear of incapacity, are circumstances common to both, and they are the very circumstances in which an anxiety state is easily set up.

It has for a long time been admitted that "neurasthenia" is a frequent complication of miners' nystagmus, and the condition itself has been called a "neurosis," but the absence of clinical meaning in these words and the ill-defined assumptions associated with them have hindered rather than helped understanding.

The chief common symptoms are: In the sphere of altered emotions; fears, depressions and inhibitions. Tremors of head and limbs; general, as psychoneurotic symptoms. Disordered action of the heart, identical with that disability known in the War as D.A.H. and now admitted to be a neurosis in the narrow sense of the word. Ocular symptoms: defect of visual acuity, night blindness, photophobia, forced ocular movements, e.g., hysterical spasm of convergence when the eyelids are forced open, and contraction of the superior recti, which tends to keep the pupil hidden under the upper lid. "Neurasthenic" symptoms: sleeplessness, headache.

A knowledgeable handling of the situation should arrest the deterioration that follows so frequently upon the first appearance of the disability.

In spite of the belief that the "neurotic" patient is too ready to talk about his symptoms, it must be emphasized that many symptoms are withheld for fear of ridicule, and these very symptoms are the ones that matter most.

The man must not be allowed to remain idle; this is the worst possible treament for such cases, and only aggravates the "psychoneurosis" by giving the man an unlimited opportunity for introspection, thus exaggerating all his fears and anxieties.

The provision of work of some kind is essential, the end in view being complete restoration to full work.

Travel.

BEYOND LEH.

A SHOOTING TRIP IN LADAKH, 1926.

Being a Diary kept by

K. W. DICKSON, F.R.G.S.

(*Continued from p.* 392.)

VI.—MACCHOI TO KARGIL.

We made a late start for Matayan, just before eight, and the baggage coolies were off before us. It was a perfect morning, a very blue sky. Unfortunately the snow was just not hard enough for us to walk on the surface, but the dogs scampered about, and their footprints could hardly be seen on the crust of snow.

FIG. 2.—Our servants leaving Macchoi Bungalow.

The bungalow made such a funny picture almost hidden in snow with icicles hanging from the roof, that I called to R. for the camera to take a photograph.

After a mile of the same kind of track as before, we came to a long uninhabited valley. There were great snow-covered mountains on every

side, and the whole undulating valley was smoothly covered with untouched snow. Here the snow was very deep; khud sticks were useless in attempting to discover its depth. The valley was extraordinarily still, not a breath stirring. I took a photograph of R. and the dogs and the tiffin coolies, sitting in the snow at a five minutes' rest.

Two miles further on there appeared to be less snow on the surrounding hills, crags showing black against the white background more frequently, and we rested on bare rocks on a hillside for ten minutes. Garry galloped miles away, burrowing beside the rocks, where there must have been marmot holes. He looked like a black dot in the distance.

In a few inches of snow near the rocks we found small yellow crocuses. There was no grass or anything green, only these brave little yellow heads amongst the snow.

We stopped for lunch beside a stream which up to now had been completely bridged with snow. The water was a beautiful clear green, and overhung with high snow walls, parts of which fell away as they melted in the sunshine. We sat for an hour, quite warm for the first time.

The remainder of the march was very trying indeed; the snow was soft and wet; the old footprints were very little use as they gave way under us, and we staggered from side to side, sinking deep at nearly every step.

We could see the flat roofs of the tiny village of Matayan a mile away, and when we looked up at each short rest, leaning heavily on our khud sticks, the village seemed no nearer. The only thing to do was to count the telegraph poles.

The bungalow is on the far side of the village, and we finally arrived very tired about two o'clock to find a sick sahib had been there since the day before: this was the man who had been held up at Baltal before we got there.

We had our legs massaged and got off our soaking boots and puttees while tea was being prepared. After tea R. went to see the sick man, an officer who had malaria. He was recovering, but R. told him he must on no account attempt to go on for another two days.

I heard Garry barking loudly to greet the arrival of another officer who came in about six o'clock, almost exhausted, having come all the way from Baltal. He had been fifteen hours on the road, and had to battle with a stinging wind and driving powdered snow in the pass.

All windows in Dak Bungalows in the district have outside boards to protect them when snow drifts up against the house, but there were panes wanting here too.

Our faces were swollen and badly burnt. Even our smooth linen pillow-slips felt like horse hair to our tender skin, and we had a restless night and little sleep. We were up before five o'clock, however, very anxious for an early start before the snow became soft in the sun.

The officer with malaria had a good night. R. gave him some medicine

from our box, and we had left the bungalow by six o'clock. To our great joy the snow was hard on the top, and it was easy walking. We walked hard at four miles an hour, even running at intervals, in our delight at being able to stretch our legs once more. The cold was intense, and we met a coolie about seven o'clock with his hair and moustache frozen white. The dogs were in great form, chasing each other and racing along.

The first three miles were very pleasant. We were in the shadow of the hills, so goggles were not necessary. After that I had to attach a cloth to my goggles to protect my blistered face from the glare, and R. had a silk handkerchief arranged to protect his burnt neck.

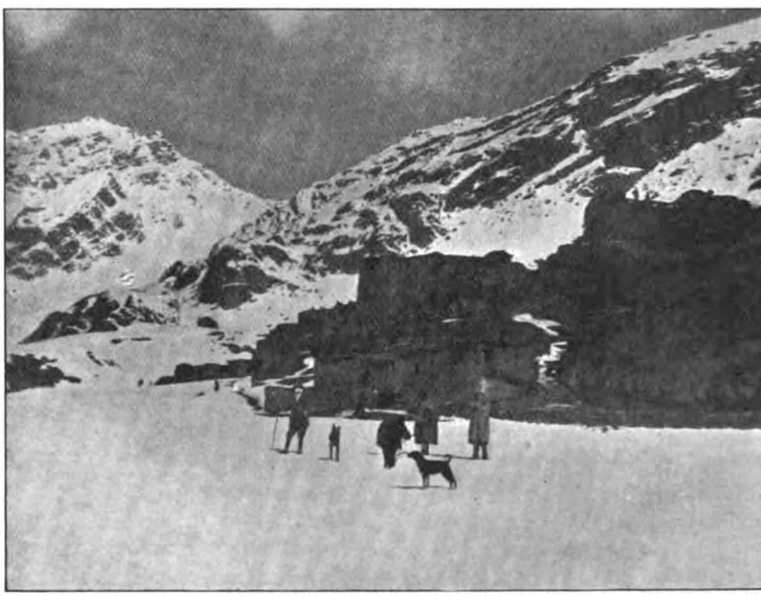

FIG. 3.—Pandras. Last march in the snow.

A ten minutes' rest in a willow plantation, and then we came to Pandras. In the plantation I picked a few pussy willow catkins just burst.

Pandras is four miles from Matayan—a few flat-roofed huts built among the rocks, like an Old Testament picture. All the children, goats, sheep and poultry were on the roofs of these huts, the only place where there was no snow. We had arranged for a pony to meet me at Pandras, as a track had been opened from there to Dras, although the snow was still three feet deep, and a shaggy little animal was led down from the village as we appeared. It had a wooden saddle inlaid with ivory and mounted with brass. We took a photograph of the valley, then the pony was led to the track, and two miles further on I was able to ride.

We came to a high bank above the river. The pony had to follow the winding path up this bank, while R. and the coolies walked across the

hard snow by the river side. I rode three or four miles where the snow had melted sufficiently to make riding possible. It was a friendly little beast, but preferred to walk on the very edge of the path. The man pulled it downhill by a long hair rope. Coming down a steep incline where the snow was deep again, the man pulled, the pony went on its knees, and I went on top of the man. After that I went down steep slopes on foot.

In this valley the snow had melted in places, showing black patches of rock, and nearer Dras there was perceptibly less snow, and the road was stony and very muddy. In Dras itself, although it is considerably lower than Matayan, there were high frozen snow drifts, and neither doors nor windows on one side of the bungalow could be opened.

It was cheery to see animals again; cows, sheep, ponies and goats were about, being fed on hay.

We spent nearly an hour that afternoon attending to our faces. R. was still very burnt, and in spite of my face protector, my chin was one large blister, and my lips so swollen that they looked like a negro's. The cold cream was frozen, and had to be put beside the fire to melt. We forgot about it, and it boiled in the tube. We put spirits of camphor on our blistered lips, and calamine lotion on our enormous ears. I thought moulds of our noses would fall off next day, leaving still more tender skin exposed.

We spent another hour repacking yakdans and kiltas. The packing could be much better arranged, as we now changed to pony transport. The boxes could be heavier, and the sacks were emptied into them. We paid off the thirty baggage coolies who had come from Gund; they got about £14; not very much for such hardships. Our money was almost done, and we had to telegraph to get some sent to Kargil, the nearest post office, two marches ahead.

R. had attended to several sick men on the road, but in Dras we had a great sick parade, with the medicine box outside. There were coolies with early snow blindness; men who had lost or broken their glare glasses. In Srinagar there must be an enormous trade in these glasses: the kind used by the coolies cost about fourpence a pair, and serve the purpose well. Other patients had coughs, shortness of breath, several with tummy aches, and a large crowd looked on with great interest.

Khazir Butt suggested that we should share a sheep with two men who were in the other half of the bungalow. Just before dinner he came and said the sahibs were outside. So we went to find them looking at the sheep, not a bad looking ram. Garry followed us out and gave the man who was holding the ram some trouble. We sent him indoors, and listened to the bargaining for the sheep. Both the officers spoke Hindustani well, and the Dras shepherd knew enough. We got the whole sheep for 10s., and our share was 3s. 6d., and included the liver and kidneys.

Again we went early to bed and slept well in spite of the cold. Dras lies in the middle of a wide plain; a very windy spot, and the shikari told me that gales blow there at all seasons.

We started for Kharbu about 6 a.m., and until 8 o'clock all the mud of last night was frozen, and the small streams were frozen solid : even the pony's feet did not break the ice. We had just come from a merciless country, but here we were in a desolate one; bleak, bare and barren : nothing but rocks, great snow-capped jagged hills, and green rapid rivers.

About half an hour was wasted at the start that morning; the pony's bridle broke and fell off; the reins felt loose; then I felt something hard in my hand, and found it was the bit. The syce tried to mend the bridle, but after three attempts, went to a house and got another in exchange. The reins were made of old pieces of cloth covered with sheepskin. The pony had a wonderful saddle ; a type I was to see often in Ladakh ; but this was a specially fine one. The wooden pommel was six inches high, inlaid with ivory ; the saddle was upholstered in maroon cloth, and looked very gay ; it was very hard, however, and I wished next day that I did not feel the after-effects of it quite so much.

There were a few scattered huts not far from Dras, and it was pleasant to hear the sound of sheep and cattle after the silence of those snowbound valleys. There was a homely farmyard smell as we passed through hamlets. Even birds began to appear again ; several pairs of magpies came quite near us, and we saw some wagtails at the water's edge.

The road was often very monotonous, up and down a shale bank by the side of the river. The soil looked black against the white background, but there was not a blade of grass anywhere.

We rested under a rock for lunch, and started off quite fresh again. The character of the country is quite different from Kashmir; the path wound round the mountain sides the whole march. The valley was narrow, and every corner presented the same features; the river, the stony road, and the bare hills; and we didn't seem to get any further. There were one or two tiny villages, but it was difficult to locate our position on the map, and we had to guess on a basis of three miles an hour. A bridge over the river shown on the map proved our calculations to be correct, which was very cheering, as it meant only six more miles. Still, we were very tired indeed one mile from the bungalow, so stopped at the roadside and had tea. The coolies made a fire with dry sticks of a sweet-smelling aromatic shrub. We rested for half an hour, and the officers with whom we shared the sheep passed us here, one limping badly. They were very glad to hear it was only a mile further. The baggage ponies had passed us while we were at lunch, so the servants had time to have everything ready for us in the bungalow. We walked the last mile feeling much cheerier and less weary after tea. We found beds made and everything prepared; even a kettle boiling, so we drank more tea while our legs were being massaged. R. found he had a nasty septic blister on his heel.

Kharbu is lower than Dras, well sheltered and decidedly warmer. There was no snow on the road after the first five or six miles, which was a very great relief. R. hadn't been able to shave for the past six days, and looked like a wild man. This was the first bungalow where we had any

privacy; a good room and dressing room; the only drawback was the usual smoky fire.

This was our longest march, twenty-one miles, and after another day on the road to Kargil, we intended to stay there to give ourselves and the servants a much needed day's rest.

On Tuesday, April 27, we were wakened by Jit Ram with tea at 5 o'clock, to find it was snowing heavily, and there were three or four inches on the ground; the willow trees in front of the house were heavily laden with snow, and it was impossible to march that day. I had wakened with a really bad headache, so I was not depressed at the idea of the unexpected day off. We went back to bed but could not sleep, we were accustomed to getting up so early. We had a really good breakfast at seven—kidney, bacon and eggs.

It snowed all day. To Kargil was only a fifteen-mile march, but the first part being in snow made it seem longer. There was a long climb over a spur, then down again, and round to where the Shingoo river joins the Dras. It was a very pretty corner; we could see the tiny path rising higher and higher leading to the Deosai, a well-known plateau for shikar. On the opposite bank of the river, R. showed me Karkitchu village, where he shot his fine red bear fourteen years ago. The road then wound round steep precipices, and we had lunch amongst the rocks.

There is a modern suspension bridge where the road branches off to Skardu; this is the parting of the ways: to the left, across the bridge, to Baltistan and Skardu: to the right, round a high rock at the junction of the Suru and Dras rivers, the path leads to Ladakh and Leh.

Two natives were fishing from the bridge, and one of them came to us offering fish for sale: we bought a couple about two pounds each, and had them for dinner that night. These river fish are very good eating, but are full of bones.

We reached Kargil, a large village with open country all round, at 2 o'clock, and went straight to the post office.

(*To be continued.*)

Current Literature.

HALDANE, J. S. **Gases met with Underground.** *Surveyor.* 1932, v. 82, 407-9.

This interesting paper deals with the presence of unusual gases in underground atmospheres. The first considered is choke-damp, or carbon dioxide, which is found in mines, wells and vaults. It is heavier than air, and may cause fatalities, due to men unsuspectingly descending into an atmosphere containing it. These accidents are due to want of oxygen, rather than to any poisonous property in carbon dioxide. Various substances met with underground combine with oxygen, and give a residue of choke-

damp. Of these, freshly broken coal is the most important. Calcium carbonate in the presence of iron pyrites will also give choke-damp; as will also the oxidation of timber underground by micro-organisms. Owing to good ventilation, the air of sewers is seldom contaminated. Choke-damp may collect in wells, and, on a fall of barometric pressure, be sucked out from underground spaces, even though the air of the well has been found quite pure a few hours earlier. It is similarly drawn out in unusual quantities from old workings in coal mines. Compressed air used in constructing tunnels has been known to drive choke-damp out of underground spaces into buildings. Marsh-gas, or methane, occurs as fire damp in coal mines; as much as 100 cubic feet of methane may be given off for every cubic foot of coal mined. Whether methane is originally formed in a coal seam by anaerobic fermentation is not certain; it appears to be so formed in marshy ground or in mud.

The cause of the Holborn explosion and fires, which occurred in December 1928, is discussed, and the suggestion is put forward that the explosion was due to gas from anaerobic fermentation taking place in subsoil, from which it was drawn by a fall in atmospheric pressure, rather than to an escape of coal gas. Attention is drawn to the formation of gases when short circuits occur in old-fashioned electric mains laid in troughs filled with bitumen. A short circuit melts and distils the bitumen with rapid evolution of gas to form an explosive mixture. Sulphuretted hydrogen is another kind of combustible gas which may be formed anaerobically from organic matter, such as sewage; it may be abundant in stagnant sewage, but is greatly soluble in water, from which it may be given off by stirring.

E. L. COLLIS.

Reprinted from "Bulletin of Hygiene," Vol. 8. *No.* 2.

KÜSTER, E. and JANITZKY, A. Versuche ueber Raumbelüftung. Mit einem Schlusswort von Prof. Dr. F. DESSAUER. **[On the Ventilation of Rooms.]** *Ztschr. f. d. Gesamte Physikalische Therap.* 1932, v. 43, 12-38, 4 figs.

This paper deals with the effects resulting from the use of an air-conditioning apparatus. The apparatus, which includes provision for heating and humidifying the air supply, is described.

The most important conclusion reached relates to the influence of ventilation on the respiratory exchange. Ventilation by means of the air-conditioning plant caused a reduction of the metabolic rate. Determinations of the state of ionization of the air were made by means of an Ebert ion-counter. It was found that the operation of the air-conditioning plant led to a marked increase in the number of negative ions, and the fall in the rate of metabolism was attributed to the effect of the excess of negative

ions. From further experiments it was found that when the ion count showed an excess of—ve ions the metabolism diminished, whilst when +ve ions were in excess the metabolism rate increased. These results agree with those obtained by Happel (see Dessauer, F., "10-Jahre Forschung auf dem physikalisch-medizinischen Grenzgebiet." Leipzig: G. Thieme, 1931) in applying Dessauer's treatment with ionized air, for he found that −ve ionization caused a diminished, and +ve ionization an increased, oxygen consumption.

The concluding note by Professor Dessauer points out that air which is passed over dry or warm metal surfaces gains an excess of medium-sized positive ions, which appear to have unfavourable biological effects (basal metabolism). T. BEDFORD.

Reprinted from "Bulletin of Hygiene," Vol. 8, *No.* 2.

PILOD, M. and CODVELLE, F. Action oligodynamique des métaux. Étude expérimentale et application à l'épuration des eaux de boisson. **[The Oligodynamic Action of Metals. Experimental Study and Application to the Purification of Drinking Water.]** *Ann. d'Hyg. Pub., Indust. et Sociale.* 1932, v. 9, 654-94. [60 refs.]

The disinfectant action of water in which silver has been immersed was discovered by Naegeli and named by him "oligodynamic action." His work and later work are here partially reviewed and the results of some further experiments are recorded. Silver is the most potent and copper, zinc, nickel and arsenic also possess the oligodynamic property, but lead, iron and tin are practically inert. If zinc is combined with copper the effect is additive. Treated water, in addition to being bactericidal, also destroys algæ and reduces the action of diastase and trypsin. Water can be rendered active very much more quickly if oxygen or carbon dioxide are bubbled through it whilst the metal is in contact, and increase in temperature also accelerates the activation. The presence of salts such as sodium chloride, sodium sulphate and potassium iodide hinder the activation, but sugars have no influence. Colloids such as albumen and adsorbents such as animal charcoal and kaolin strongly inhibit the activation of a treated water. In discussing the application of oligodynamic action to the purification of drinking water, the main conclusion reached is that the process cannot at present be used with safety owing to the presence in the water to be purified of suspended matter which would be likely to inhibit the action of the immersed metals. The surface of the reservoirs themselves might also behave as do adsorbents in laboratory experiments in inhibiting the oligodynamic action. M. E. DELAFIELD.

Reprinted from "Bulletin of Hygiene," Vol. 8, *No.* 2.

PETER, W. W. **The Cleaner the Swimmer—the Cleaner the Pool.** *Municipal Sanitation.* 1932, v. 3, 285-6. [Summary taken from *Pub. Health Engineering Abstr.* Wash. 1932, Oct. 22, v. 12. Signed H. B. FOSTER, Jr.]

In all well-managed natatoriums sanitary regulations include control of the actions of patrons as well as supervision of the water in which they swim. Pre-swim precautions are just as necessary for health protection as is safe water. A cleansing bath before the swim is too important a matter to be left to the individual choice and there should be a system inaugurated for checking up. One method is to issue suits after a shower has been taken, and the attendants can see if this has been done.

Bathing instructions should make special mention of the cleansing of the feet. An additional precaution is the use of chemical solution foot baths to prevent possible spread of ringworm. Serious cases of ringworm should be barred from the pools, and the sufferers advised to seek medical treatment. Persons showing any other symptoms of skin infection, signs of a cold, or evidences of any communicable diseases should not be permitted to enter the pool. Bathers should be forced to refrain from spitting, spouting water, or blowing the nose in the pool.

The management should keep the equipment as sanitary as possible by scrubbing the floors and mats with soap and water. A daily application of two per cent formalin will destroy any ringworm present, but should be left on for half an hour. Clean suits and towels should be segregated at all times from soiled ones, and should not be issued across the same counter where the used ones are returned. Epidemics of skin diseases have been traced to such careless handling of supplies.

Over thirty States have passed laws regulating swimming pools, and practically all State laws require a pre-swim bath with warm water and soap and call for clean suits, clean towels, and clean equipment. The final responsibility rests on those in charge, and they should aim not only to be familiar with their legal obligations, but to exceed such requirements if supplementary measures will provide further protection for the public health.

Reprinted from "Bulletin of Hygiene," Vol. 8, *No.* 2.

BRODIE, M. **A Comparison between Convalescent Serum and Non-Convalescent Serum in Poliomyelitis.** *J. Exper. Med.* 1932, v. 56, 507-19. [15 refs.]

The author records a series of careful and detailed titrations in which the neutralizing power for poliomyelitis virus of pooled convalescent sera has been compared with that of normal adult sera obtained from persons living in an urban district (Montreal). Of 29 adult sera tested, 14 came from persons who were known to have been in contact with cases of poliomyelitis. Of the 29 sera, 7 had less than $\frac{2}{5}$ the protective power of the pooled convalescent serum; 3 had $\frac{2}{5}$ this protective power; 2 had $\frac{3}{5}$; 8

had $\frac{4}{5}$; and 9 had at least an equal protective power. Six of these last 9 sera were tested further; 2 of the 6 had a higher protective power than the pooled convalescent serum, 80 completely paralysing doses of virus being neutralized by 0·033 cubic centimetre adult serum as against 0·04 convalescent serum. Known contacts and avowed non-contacts were equally represented in the sera of low-neutralizing potency; but in the sera of higher potency the known contacts slightly predominated. The pooled sera of known contacts had a protective value slightly greater than half that of the pooled convalescent serum, the pooled sera of avowed non-contacts a protective value slightly less than half that of the pooled convalescent serum.

Particulars are appended to the paper of 16 early cases of poliomyelitis treated with pooled sera from selected normal adults, and of 25 similar cases treated with pooled convalescent serum. The results did not differ significantly; 5 of the 25 cases treated with convalescent serum, and 3 of the 16 cases treated with normal adult serum, developed paralysis.

W. W. C. TOPLEY.

Reprinted from "Bulletin of Hygiene," Vol. 8, No. 2.

PRÖSCHOLDT, O. Die Feststellung der Ausscheidung von Abortus-Bang-Bakterien mit der Milch. **[The Excretion of *Br. abortus* in Cow's Milk.]** *Deut. Tierärzt. Woch.* 1932, v. 40, 673-85. [18 refs.]

This article gives the results of an extensive investigation into the excretion of *Br. abortus* in milk. Only some of the more important conclusions can be summarized here.

In the detection of *Br. abortus* in milk by the guinea-pig inoculation method it is advisable to inject a mixture of cream and sediment obtained by centrifugation. Agglutinins are sought for in the animal's blood after four, six and eight weeks. The guinea-pig is killed after eight weeks, and cultures are made from the spleen. Thirty-five per cent of animals that showed agglutinins at eight weeks failed to react at a titre of 1 : 20 after four weeks, and three to four per cent were still negative at six weeks. Positive cultures were only seldom obtained from animals failing to show agglutinins at eight weeks. About 60 to 70 per cent of animals agglutinating at 1 : 20 yielded positive cultural results. It is concluded, therefore, that a titre of 1 : 20 or over is very strong evidence that the guinea-pig is infected with *Br. abortus*.

In performing the agglutination test on whey, it is unimportant whether fore-, middle- or end-milk is used. It is highly desirable, however, to test the milk of each quarter of the udder separately, since agglutinins may be present in one quarter and absent from the remaining quarters.

Comparing the relation between the presence of agglutinins in the cows' serum, the presence of agglutinins in the milk whey, and the excretion of *Br. abortus* in the milk, the following observations were made:—

No. of animals examined	Serum titre	No. with whey titre of 1 : 10 or over	No. excreting *Br. abortus* in milk
199	< 1 : 100	2	6
94	1 : 100	22	17
83	1 : 200	38	31
56	1 : 400	40	35
32	1 : 800	24	23
20	1 : 1,000	18	14
47	1 : 2,000	45	36
26	1 : 4,000	22	24
26	1 : 8,000 or over	25	24

It is concluded that only 3 per cent of cows with a serum titre of less than 1 : 100 excrete *Br. abortus* in the milk, and that 81 to 86·6 per cent of milk excretors give a positive whey reaction [this is not evident from the table, but is supported by figures in the text]. Further analysis of the figures indicates that cows with a whey titre of 1 : 80 or over are almost certainly milk excretors. A whey titre of 1 : 10 to 1 : 40 is less certain evidence of this, though it betokens the necessity of careful and repeated examinations for the presence of *Br. abortus* in the milk. Comparison of the serum and whey titres in the same animal showed that in fifty-five animals the whey titre was higher than the serum titre. Taking this in conjunction with the fact that whey agglutinins were often absent in milk from one or more quarters of the udder, it is concluded that the agglutinins in whey for the most part do not come from the blood-serum but are formed locally in the udder in response to a localized infection. The presence, therefore, of agglutinins in the whey of a single quarter is strong evidence that this quarter is infected.

The direct cultivation of *Br. abortus* from milk was most successful when 0·15 cubic centimetre of the milk was seeded on to liver agar plates containing 1 : 100,000 gentian violet, and incubated in an atmosphere of 10 per cent CO_2. Considerably higher results were obtained with the pure milk than with either the cream or the sediment separately.

Comparisons made on 163 samples of milk yielded 145 positives by the guinea-pig inoculation and 131 positives by the direct culture method, the two methods agreeing in 64 per cent of positive cases. The authors therefore advise the guinea-pig inoculation method only when direct culture has failed.

Of 208 cows in whose milk *Br. abortus* was demonstrated, 145 had aborted and 63 had calved normally. Of the 145 aborting animals, 22 had aborted 366 to 730 days previously. This fact indicates that *Br. abortus* may be excreted in the milk for a long time after abortion has occurred.

In milk-control work the authors make the following recommendations :—

(1) Examine the blood-serum of all cows not vaccinated within the previous eleven months. (2) If the serum titre is less than 1 : 100, the animal is unlikely to be excreting *Br. abortus*. (3) If the serum titre is 1 : 4,000 or over, the animal can be regarded as an excretor. (4) If the

serum titre is between 1 : 100 and 1 : 200, whey agglutinin tests should be made from the individual udder quarters. Animals with a whey titre of 1 : 80 or over can be regarded as excretors. In animals with a whey titre of less than 1 : 80, the milk should be examined by direct culture, and if this is negative by animal inoculation. (5) If the serum titre is between 1 : 800 and 1 : 2,000, the whey agglutinin titre should be determined. If this is 1 : 20 or over, the animal can be regarded as an excretor; if it is less than 1 : 20, the milk should be examined by culture or animal inoculation.

G. S. Wilson.

Reprinted from "Bulletin of Hygiene," Vol. 8, No. 2.

Reviews.

The Discharging Ear. By Arthur G. Wells, B.S., M.B., D.P.H., J.P., Barrister-at-Law, &c. London: John Bale, Sons and Danielsson, Ltd. 1932. Pp. x + 92. Price 2s. 6d. net.

Dr. Arthur Wells in his monograph, "The Discharging Ear," has set out primarily to aid the general practitioner in his diagnosis. This he has definitely done.

The chapter on the external auditory meatus should be of great help to medical officers confronted with the plagues of hot-weather furuncles, etc., both as to the diagnosis and appropriate treatment. Acute otitis media is dealt with in the same clear-cut manner, and the descriptions of both diagnosis and treatment are sound and should well repay the reader.

Dr. Wells' treatment of chronic suppurative otitis media is ionization and ionization alone. This appears to be the only weak part of the book from a service point of view. Ionization cannot be carried out by medical officers in out-stations, who have not the necessary apparatus nor the required training in ionic medication. It is felt that it would have been more helpful if one or two other methods had been described in detail.

Chapters on mastoiditis and intracranial complications are full of guidance.

One can confidently recommend the book as an epitome of the essentials in diagnosis and treatment of the discharging ear.

W. A. D. D.

A Shorter Surgery. By R. J. McNeill Love, M.B., M.S., F.R.C.S. Third edition. London: H. K. Lewis and Co., Ltd. 1932. Pp. viii + 413. Price 16s.

That this book has reached its third edition in six years speaks for itself. Although there appears to be a slight increase in size there is the fact that the illustrations are now included in the text instead of being on separate unnumbered pages.

As the author states, an attempt has been made to condense the more important principles of surgery, and the book is intended to be read in conjunction with one of the surgical textbooks. Emphasis has been laid on "those examination requisites that the student often lacks." This is quite true, and one can say further that those requisites that are stressed are not only of use for examination purposes, but for creating an orderly and practical knowledge of the art of surgery.

The book is a short volume as surgery goes—only 413 pages—and as a help to candidates for higher examinations to condense and crystallize their knowledge, and for those who are faced with an examination in surgery after possibly a long respite from examinations, it will prove of the utmost assistance.

The book is excellently and profusely illustrated, it is easy to read and, as the author hopes, should enable one to gain an orderly and really useful knowledge of surgery.

J. M. W.

THE PRINCIPLES AND PRACTICE OF PSYCHIATRY. By Alexander Cannon M.D., Ph.D., D.P.M., and Edmund T. T. Hayes, M.D., D.P.M. London: William Heinemann, Ltd. Pp. xvii + 437. Price 25s. net.

This is an excellent textbook for examination purposes—its object as stated by the authors in the preface.

The section dealing with law and the legal problems arising in connection with the practice of psychiatry is very complete and up-to-date. The salient facts of normal psychology and psychopathology are well brought out. In the chapters on the diagnosis and treatment of mental disorder much of the information is presented in more or less tabulated form.

The authors obviously are experienced teachers and have studied the requirements of the various examining bodies in psychological medicine.

COMMON SKIN DISEASES (General Practice Series). By A. C. Roxburgh, M.A., M.D., B.Ch., F.R.C.P. London: H. K. Lewis and Co., Ltd. 1932. Pp. xxx + 310. 110 illustrations and 8 coloured plates. Price 18s. net.

Most of us who are not specialists in skin diseases find the average textbook on the subject, excellent as it may be, rather bewildering; it is frequently too deep for our purpose and offers so many treatments of the various conditions, that we hesitate as to which is best to apply to an individual case. The present volume is a pleasant contrast.

The book is written for the general practitioner and describes such conditions as he is likely to meet. Stress is laid on differential diagnosis, the part of the problem in which most guidance is required. At the beginning of the book an index of preliminary diagnosis has been placed

to encourage the student to observe accurately the type of lesion of which any given eruption is composed and to guide him as to what diseases to look up. The descriptions of the various disorders are lucid and the directions for treatment are admirably concise—we are never left with any doubt as to what is the method to adopt. The use of ultra-violet light and carbon dioxide snow, which are employed by many general practitioners, is described in some detail, while treatment as by X-ray, radium and electricity, which come properly into the sphere of the specialist, are not described, although the indications for their employment and the results to be expected from their use are fully dealt with.

The volume is excellently produced and the illustrations and plates are well chosen and helpful.

We can confidently recommend the book to anyone requiring a thoroughly practical help in dealing with skin diseases in general practice.

Correspondence.

ANTI-MOSQUITO MEASURES.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I was pleased to learn from Captain Woods' letter dated January 19, 1933, that Northern Command Instructions served a useful purpose. It is a moot point whether such instructions should come under the generic term of literature.

"Follow up notes" on anti-malaria and other measures are particularly valuable since they keep us all in touch with the practices which are standing the test of time and provide material for discussion.

It must be conceded that such instructions only deal with principles and cannot specifically cover the multifarious physical characters found in a group of cantonments or even in different parts of a single station. Also, owing to their nature, their full implication is not readily apparent. Hence, from the point of view of anti-malaria co-ordination, financial and technical, tours are essential.

If I am permitted to invite a reference to my letter of December 12, 1932, paragraph (1) stipulates that the provision of a circumvallate runnel is governed by the relationship which the borrowpit bears to surrounding gradients, and if this is properly constructed should not hold up water. On virtually dead flat surfaces, like the rifle ranges at Sialkot, there is an absence of fall and a protective runnel is logically superfluous.

My first introduction to the grading of borrowpits to a sump in the Punjab occurred in 1912-13, and I agree that under ordinary conditions and in the case of small borrowpits such a method is frequently successful.

The Northern Command Instructions were equally applicable to small rifle pits and to the enormous railway and other borrowpits found around Lahore, &c. The treatment of these is undoubtedly an engineering problem. Numerous methods, including that adopted by Colonel Mackenzie of boring to the first pervious stratum, have been tried with varying success.

Sialkot is fortunate in having available a large Depôt of keen and skilled personnel in the Corps of Sikh Pioneers, and for several years in this station a large proportion of the anti-malaria funds at the disposal of Northern Command Headquarters was disbursed as extra duty pay. Furthermore, the tube well trial borings at Sialkot itself indicated that it was only in certain areas that the superficial impermeable strata showed faults or were ill-defined.

In other Punjab cantonments absorption from these large borrowpits was poor and when using contract labour the procedure was productive of only transient amelioration, at a considerable cost, and did not preclude subsequent puddle formation. Hence in these situations herring-boning provided the only means of expeditiously conveying the water to a sump from which it was occasionally pumped or the residual water conveniently treated with film-forming larvicides.

Headquarters, Southern Command,
Salisbury,
April, 13, 1933.

I am, &c.,
C. H. H. Harold,
Major, R.A.M.C.

INDEX TO VOLUME LX.

C.N. = Clinical and other Notes.
C.L. = Current Literature.

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